User Manual — Tobii Studio

Version 3.3.0

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1 Introduction

Tobii Studio™ offers a comprehensive platform for the recording and analysis of eye gaze data, facilitating the interpretation of human behavior, consumer responses, and psychology. Combining an easy preparation for testing procedures and advanced tools for visualization and analysis, eye tracking data is easily processed for useful comparison, interpretation, and presentation. A broad range of studies is supported, from usability testing and market research to psychology and ocular-motor physiological experiments. The Tobii Studio's™ intuitive workflow, along with its advanced analysis tools, allow for both large and small studies to be carried out in a timely and cost-efficient way, without the need for extensive training.

Tobii Studio™ supports a large variety of stimuli and allows both multiple and different stimuli types to be combined into a single recording. A holistic view of behavior is achieved by integrating the recording of eye tracking data with user video, sound, key-strokes, mouse clicks, and other data sources into a single solution.

1.1 Usability Studies

Tobii Studio™ is very well suited for evaluating user experience in regard to:

- Websites
- Software
- Computer games
- Interactive TV
- Handheld devices
- Other physical products

1.2 Advertising Testing

Tobii Studio™ is ideal for testing advertising design on a variety of media:

- Packaging and retail shelf design and placement
- Web advertising
- TV commercials
- Print advertising, digitally scanned and presented on a monitor
- Print advertising, using the actual physical print

1.3 Psychology & Physiology Research

Tobii Studio™ is suitable for a wide range of psychological and physiological experiments, such as:

- Infant research
- General psychological response studies, including the use of scan-paths, gaze distribution, gaze response times, and manual response times
- Studies of autism, ADHD, and schizophrenia
- Reading studies
- Studies of ocular-motor behavior and vision deficiencies

1.4 Internet Resources

Tobii Studio™ related material, such as release notes, manuals and detailed system recommendations can be downloaded from the Support & Download section at www.tobii.com. To download the available material, you need to use your product license key or contact Tobii Support for login details.

You can also find other Tobii Studio™ materials at various social media sites, such as YouTube.com (Tobii Studio™ demo and short tips videos), Scribd.com and SlideShare.net. To access those materials, go to the respective website and search for TobiiEyeTracking, Tobii, or Tobii Eye Trackers, or visit the Products & Services section at www.tobii.com.

1.5 Additional Publications and Resources

For additional information on how to use Tobii Studio™ you can watch the video walkthrough and practice with the Tobii Studio™ Tutorial Project that is included on the Tobii Studio™ Installation CD, or downloaded from www.tobii.com (Products & Services section).

Information on different configurations for the Tobii TX Series Eye Tracker setups can be found in the eye tracker user manual that is shipped with the eye tracker. If the manual has been misplaced or lost, you can download a PDF version of the manual from the Support & Download section at www.tobii.com.

Detailed documentation on Tobii Studio™ timing of stimulus display, as well as Tobii Eye Trackers sample timing information, is available upon request. Contact Tobii Support or your sales representative in your area to obtain a copy of the Timing Guide for Tobii Eye Trackers and the Eye Tracking Software whitepaper.

E-Prime® Extensions for Tobii combine E-Prime® Professional Stimulus Presentation Software with the ease of use of Tobii Eye Trackers and Tobii Studio's visualizations and AOI analysis. The E-Prime® Extensions for Tobii includes the script necessary to integrate E-Prime with Tobii Eye Tracking Technology. E-Prime® Extensions for Tobii documentation can be downloaded from www.tobii.com (Support & Download section) and http://www.pstnet.com/eprime.cfm (Support section). To download the documents you need to have valid licenses for E-Prime®, E-Prime® Extensions for Tobii and Tobii Studio™. Contact Tobii Support and register at the PST Web Support Site.

1.6 Training

Tobii Technology provides Tobii Studio™ online and onsite training. Our training solutions are tailored to fit our clients' knowledge levels and needs, and cover everything from how to use our products, to basic understanding of eye tracking methodology. For more details on the available courses, visit the Products & Services section at www.tobii.com or contact the Tobii sales representative in your area. Alternatively, you can also send an e-mail to training.analysis@tobii.com.

1.7 Tobii Studio™ Editions

Tobii Studio™ is available in three editions: Live, Professional and Enterprise. The table below shows the features available in each of the Tobii Studio™ editions.

Features		**Live**	**Professional**	**Enterprise**
Test Design	Instruction stimuli	•	•	•
	Image stimuli	•	•	•
	Movie stimuli		•	•
	Web stimuli		•	•
	PDF stimuli		•	•
	Questionnaire stimuli		•	•
	Scene camera		•	•
	External video		•	•
Recording	Eye gaze	•	•	•
	Independent variables	•	•	•
	Stimuli-related events	•	•	•
	Keystrokes and mouse clicks	•	•	•
	Web page transitions and scrolling (Internet Explorer)		•	•
	Event Logging		•	•
	User video and sound		•	•
	Local live viewer		•	•
	Remote live viewer over IP			•
	Retrospective Think Aloud (RTA)			•

Features		Live	Professional	Enterprise
	Presentation Sequences		•	•
Replay	Gaze replay	•	•	•
	Video clips		•	•
Visualization	Gaze plot	•	•	•
	Heat map	•	•	•
	Areas of Interest (AOIs)	•	•	•
	Automatic cluster AOIs			•
Statistics	Descriptive statistics tables and charts	•	•	•
Data Filters	Fixation filters	•	•	•
	Raw data visualization & export (un-filtered gaze data)	•	•	•

2 Installing and Updating Tobii Studio

The objective of this chapter is to instruct you in how to install and update Tobii Studio on the computer you are going to use to record eye tracking data. For details on how to set up Tobii Eye Trackers or Eye Tracking hardware, please read the respective user manuals.

For optimal performance, Tobii Studio should be installed on a computer that follows the Tobii Studio and Tobii Eye Trackers System Recommendations. This document is available at www.tobii.com (Support & Downloads section), or can be obtained from your local sales representative.

Tobii Studio software can be used to incorporate much more than just recording of eye tracking data. Various video and audio streams and integration with other software and hardware may also be utilized. Make sure that when you use additional components, such as video capture cards and cameras, that you have the correct drivers installed on your system and that they follow the System Requirements and Recommendations (available for download at www.tobii.com).

2.1 Before installation

Tobii Studio uses Windows programming components, drivers, and eye tracking firmware (e.g. APIs and frameworks) to display and record the eye tracking data and stimulus. If they were not previously installed, these components are automatically installed by the Tobii Studio installer.

Tobii Studio is compatible with Windows XP, 7 and 8.1(32- and 64-bit versions).

2.1.1 Install the driver for the eye tracker built-in user camera

If the eye tracker has a built-in user camera (Tobii T –Series Eye Trackers) and its serial number is equal to or lower than TTXXX-204-XXXXXXXX you need to manually install the user camera driver. This driver is not compatible with Windows 64-bit versions.

2.2 Installing Tobii Studio

To install Tobii Studio you need the Tobii Studio CD and a softwarelicense key. The license key is used to activate Tobii Studio after it is installed on the computer. Tobii offers single-user and multiple-user licenses. A single-user license includes a key for each copy purchased. A multi-user license includes one key with entitlement to install the software on multiple workstations or for multiple users on the same workstation.

License activation can be conducted when first running Tobii Studio or up to 5 days later, if you are not able to connect to the Internet during the installation.

The Tobii Studio license key is located inside the Tobii Studio CD cover. Use manual activation if you have problems activating your license or do not have an Internet connection.

To install Tobii Studio:

1. Insert the Tobii Studio CD in your computer.
2. Open the Tobii Studio CD folder.
3. Double-click TobiiStudio_installer_###.exe (### represents the Tobii Studio version number).
4. Follow the on-screen prompts and instructions to complete the installation.

Start Tobii Studio by clicking the icon on your desktop to launch Tobii Studio. Alternatively, click Start menu > All Programs > Tobii. From the Tobii menu, select Studio and then click the Tobii Studio application.

The first time you run Tobii Studio, you will need to provide the license key to run the software.

To uninstall Tobii Studio:

1. Open the Windows Start menu and select All Programs.
2. Click Tobii Studio.
3. Click Uninstall Tobii Studio.

4. Follow the on-screen prompts and instructions to remove Tobii Studio.

2.2.1 License key activation

When you use Tobii Studio for the first time, start by typing the license key in the License key text field. After typing the license key, you have the option of selecting either Activate Now or Activate Later:

- If your computer is connected to the Internet, type your organization name and an e-mail address in the respective fields and then click Activate Now. The activation process is initiated and you can start using Tobii Studio once it is completed.
- If you do not have an Internet connection, regardless of whether not you will in the future, click Activate later.

By clicking Activate Later, you have a grace period of 5 days to activate Tobii Studio. The License Data dialog box will appear every time when you start Tobii Studio until it has been activated. If the software has not been activated within the 5 days, you will not be able to run Tobii Studio without activating it.

Automatic activation can also be used after you have started Tobii Studio. Open the Help menu in Tobii Studio's main menu and click Activate License - Automatic.

If an error occurs, a message will appear stating that you were not able to activate Tobii Studio. Click the Yes button to continue to the manual activation or click No to activate automatically at a later stage.

To activate the license key manually:

1. Start Tobii Studio. In the License Data dialog box, click the Activate Later button. A dialog box opens informing you that "Your Tobii Studio software must be activated in 5-1 days".
2. Create a new project or open an existing project (for details, read *3.1 Creating a new project* and *3.2 Opening an existing project*).
3. Open the Help menu on Tobii Studio's main menu and click Activate License – Manual... to open the Manual activation dialog box.
4. In the Manual Activation Information box, you can find the information needed to activate your license. You can save that information in a text file by clicking the Save as file button.
5. You can then choose between three methods to activate your license:
   - Open your web browser and go to the activation page http://StudioHelp.tobii.org/Activate (if possible on a different computer) and enter the license key, machine ID and organization information in the designated fields on the page and click Activate.
   - Send an e-mail to support@tobii.com. The e-mail should contain the company name, license key and machine ID (eye tracker ID) — all this information is provided in the pop-up mentioned at step 4.
   - Call Tobii support at one of the phone numbers shown in the manual activation window.
6. An activation code is obtained from the web page or from support.
7. Enter the activation code in the Enter Manual Activation Code field. If successful, the following message should appear: Thank you for activating Tobii Studio. You may now start using it.
8. Click OK to start using Tobii Studio.

If the activation is not successful, an error message will be shown. Contact support and provide them with the information shown in the error message.

2.2.2 License deactivation

Tobii Studio's license key policy also allows single license keys to be deactivated and reactivated more than once, allowing you to install Tobii Studio on multiple computers and then switch between the computers.

In case you have purchased multiple-user licenses, each license key can only be activated on one computer or for one user account at a time.

To deactivate the Tobii Studio license key:

1. Connect the computer to the Internet.
2. Start Tobii Studio.

3. Create a new project or open an existing project (for details, read *3.1 Creating a new project* and *3.2 Opening an existing project*).
4. Click Help on Tobii Studio's menu bar and then click Deactivate License.
5. Click Yes in the warning dialog box and wait until it connects to the server.
6. Click OK and Tobii Studio exits.
7. If you start Tobii Studio again, you will be prompted to enter a license activation key.
8. Click the Activate Now button if you wish to reactivate your license.

2.2.3 How to change the license key information

The License Data dialog box displays the license key and Tobii Studio edition information, together with your organization name and contact e-mail address.

To check the license key reference and the Tobii Studio edition:

1. Start Tobii Studio.
2. Open an existing project or create a new project (for details, read *3.1 Creating a new project* and *3.2 Opening an existing project*).
3. Click Help on Tobii Studio top menu bar and then click About Tobii Studio.
4. The About Tobii Studio dialog box displays information about the Tobii Studio version, edition, license key and whether it is activated or not.
5. To change the license key, click the Enter license key... button to open the License Data dialog box.
6. In the License key field, select the existing license key and press DELETE.
7. Type the new license key.
8. Click Activate Now or Activate later to close the License Data dialog box.

2.3 Connecting Tobii Studio to a Tobii Eye Tracker

To verify that the Tobii Studio computer and your Tobii Eye Tracker are correctly configured, check if you are able to connect Tobii Studio to the eye tracker.

To test the connection:

1. Start Tobii Studio by clicking the icon on your desktop.
2. Open an existing project or create a new project and test (for details, please read *3.1 Creating a new project* and *3.2 Opening an existing project*).
3. On the Design and Record tab, click Setup and select Settings.... This will open the Global Settings dialog box.
4. Select the Eye Tracker tab and click the eye tracker in the eye tracker list.
5. Verify that the eye tracker is connected by checking the Status value corresponding to the eye tracker in the list.
6. Click OK to close the Global Settings window.

For details on how to set up the Tobii Studio computer and your Tobii Eye Tracker, read the Tobii Eye Trackers user manuals.

2.4 Eye tracker firmware upgrade

When you start Tobii Studio and connect a Tobii Eye Tracker, Tobii Studio will automatically detect if the eye tracker has the latest Tobii Eye Tracker Firmware installed. If the Tobii Eye Tracker has an old version of the firmware a message window is displayed prompting you to upgrade the eye tracker firmware. Click Yes if you wish to upgrade the eye tracker firmware or No if you wish to keep the current version of the firmware.

To upgrade the eye tracker firmware manually in Tobii Studio:

1. Open the Eye tracker Selector dialog box/tab by either clicking the connection status button on the Design and Record tab or by opening the Global Settings dialog box and selecting the Eye Tracker tab.

2. Select the eye tracker by clicking the eye tracker row in the Available Eye trackers list.
3. Click the Upgrade eye tracker button. The Eye Tracker Browser dialog box will open and the upgrade process will start immediately.
4. When the upgrade process is completed, click OK to close the Eye tracker Selector dialog box or Global Settings dialog box.

Firmware upgrades can improve the eye tracker's performance and set of features. Upgrading the eye tracker's firmware may fix bugs, resolve connection and trackability issues, or improve compatibility with new operating systems.

Firmware upgrades may have an impact on the eye tracking data. If you are in the middle of performing a recording, a firmware upgrade is not recommended.

2.5 Updating Tobii Studio

Tobii is committed to complying with the dynamic requirements of its clients, and releases several version updates of Tobii Studio each year. Customers with a valid Support & Upgrade contract are entitled to free software updates and free technical support.

If you are connected to the internet, you will be prompted if you are using an old version of Tobii Studio when you start it.

To update Tobii Studio:

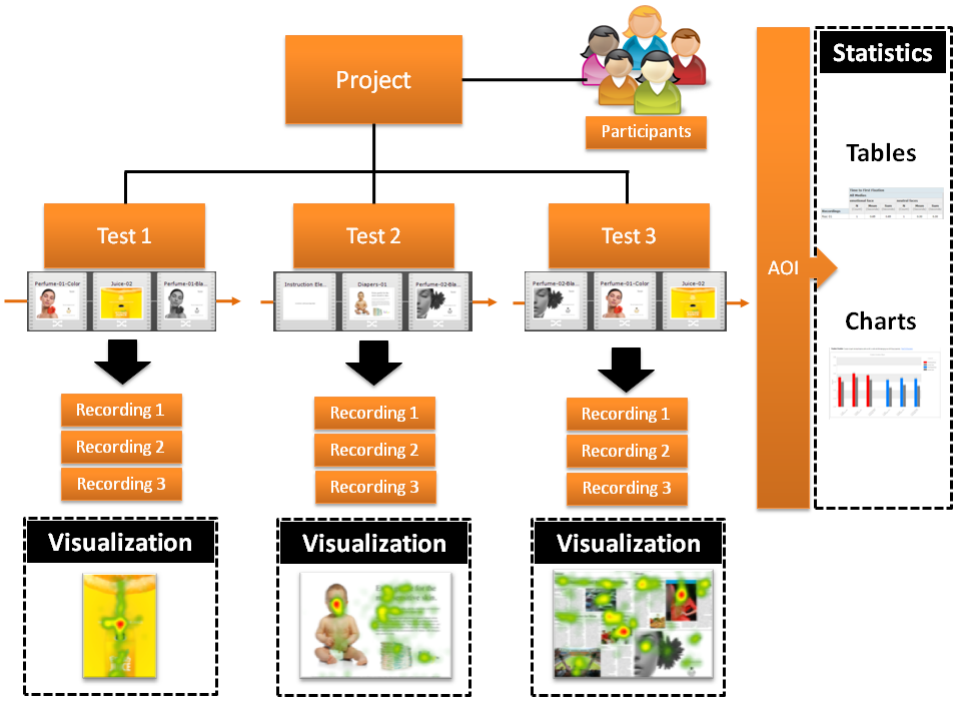
1. Click Help on Tobii Studio menu bar.
2. Select Check for Updates.
3. If an update has been released, it will be displayed in the Check For Update dialog box, under Available updates to download.
4. Download the release notes by clicking the Release notes link. Release notes contain important updates and complementary information to this user manual. Please read the release notes before installing the new version of Tobii Studio.
5. Click the Download link and in the Download dialog box and then click Save file to start downloading the installation file for the new version of Tobii Studio.
6. When the download is complete, browse to the folder where the installation file was downloaded and double-click on the installation file.
7. Follow the on-screen prompts and instructions to complete the installation.

Tobii Studio upgrades improve program performance and the feature set. They also fix bugs, resolve connection and timing issues, and improve compatibility with new operating systems. **Check for updates on a regular basis.**

Upgrades may have an impact on the eye tracking data. If you are in the middle of performing a recording, an upgrade is not recommended.

3 Managing Tobii Studio Projects

Tobii Studio organizes and stores information on three hierarchical levels: Projects, Tests, and Recordings. The top-most level is the Tobii Studio Project. This level contains participant data and one or more tests. Each test created within a project contains one or more media elements (the stimuli), which are organized into a single linear timeline and recordings.



The test also contains information on how the different media are presented to the test participant, such as the order and the duration of each media element. Recordings include gaze data, media presentation events (e.g. media start and stop times, mouse clicks, and key presses), and recording elements (e.g., videos from screen recordings or video capture devices). Each recording is associated with a participant and his or her unique calibration.

The project and test structure of Tobii Studio allows you to perform an experiment with different tests on the same group of participants. For example, if you want to conduct an experiment using a factorial design, you can have multiple tests within a single project, where each test contains the same media, but in a different order. Or, for A/B comparison testing, each test could contain different media representing the different alternatives.

Visualizations are created based on the recordings belonging to their respective tests. You can consequently only create a heat map for individual tests within a project, even if the same image can be found in more than one of the tests. However, the Statistics tab can be used to perform cross-test analysis within the same project. For example, you can group Areas of Interest (AOI) belonging to media located in different tests and use that group to extract descriptive statistics based on eye tracking metrics.

3.1 Creating a new project

In order to start designing an eye tracking test, you first need to create a new project in Tobii Studio.

To create a new project:

1. Start Tobii Studio. This opens the Tobii Studio Project Library.
2. Click the Create New Project button. The Create new project dialog box opens.
3. Name the project by typing the name in the Project Name field.
4. Optionally, type a short project description in the Description field
5. Optionally, type in the Author name

6. Click Browse... to select the folder where the project should be saved. If the folder path is not changed, the project will be saved in the default folder: Documents\Tobii Studio Projects.
7. Click Next when done.
8. Now give the test a test name and if desired, add a description. In the next step, the first test is created.
9. Click Create and you are ready to start designing your test.

If, at a later point you wish to change the project information (Project Name, Description, and Author) in the Project Library, click the Edit icon on the row of the project you would like to modify.

It is not possible to store the Tobii Studio project(s) on an external or network hard-drive.

3.2 Opening an existing project

Once a project has been created, it is listed in the Tobii Studio Project Library dialog box.

To open an existing project from the project list:

1. Start Tobii Studio to display the Tobii Studio Project Library dialog box, or, if Tobii Studio is already running, choose File>Open Project to open the Tobii Studio Project Library.
2. In the project list, double-click a project to open it. Alternatively, click the project to highlight it and then click Open.

3.3 Linking a project to the project library

You can copy and paste Tobii Studio projects between different computers or disk drives and link them to the Tobii Studio Project Library.

To link a project to the project library:

1. In the *Tobii Studio Project Library* window, click the **Link Project to Library** button to open Windows Explorer.
2. Browse to the appropriate project folder.
3. Double-click the project folder to open it in Windows Explorer.
4. Click the database file .db3 and then click **Open** to add it to the project list.
5. You can now open the project within the*Tobii Studio Project Library*

When you link a project to the Tobii Studio Project Library, only a link is created in the library, while the project archive (tests, stimuli, and recording database) remains in its original location. The project location is listed in the Tobii Studio Project Library's project list under the Path column.

For instructions on how to remove a project from the Tobii Studio Project Library, please see *3.6 Deleting and removing projects from the project library*

3.4 Exporting and importing projects

Projects can also be exported as a single, compressed file (.nas) and imported into another copy of Tobii Studio running on a different computer. These files contain all the information and elements included in the original project and once the file is imported into another Tobii Studio workstation, it can be used to perform the same tests as the original.

To export a project:

1. Start Tobii Studio.
2. Open the project to be exported.
3. On the File menu, select Export Project Archive. The Export Project dialog box will open.
4. Select the tests and recordings to export and click the Export button.
5. In the next window, browse and select the export location and type a file name.

6. When the export is finished, a confirmation dialog box will appear. Click OK to exit the export process.

If you intend to send the .nas file over e-mail, ftp or internet it is recommended to compress the .nas file as a .zip archive.

To import a project:

1. Start Tobii Studio. The Project Library dialog box opens.
2. Click Import Project Archive.
3. Click Browse... to open the Windows Explorer dialog box and browse to the file to import.
4. Click the file to select it and then click Open.
5. After loading, you can select or unselect specific tests or recordings by clicking Show archive contents and selecting the recordings to be imported.
6. The project name, description, author, and new location can be changed by expanding the Show project details.
7. Once the appropriate files and settings have been chosen, click Import. If a project with the same project ID already exists, there are two options: save the project as a new project or merge it with the old. read the following section *3.5 Merging Tobii Studio projects*. The project will appear in the project list when the import is finished.

3.5 Merging Tobii Studio projects

Tobii Studio allows you to create a project with one or more tests (the "parent" project) and then export this project to other Tobii Studio workstations where the test recordings can be carried out in parallel. The recordings and eye tracking data can then be merged back into the original project for analysis. A project with the same name must exist in the project list in order to merge two projects.

To ensure that the recordings are merged into the correct test, do not make any changes to the test design and details in the child project.

To merge two projects:

1. Start Tobii Studio to open the Tobii Project Library dialog box.
2. Click Import Project Archive. Click Browse... to open the Windows Explorer dialog box and browse to the file you want to merge.
3. Click the file to select it and then click Open.
4. After loading, you can select or unselect specific tests or recordings by clicking Show archive contents and selecting the recordings to be imported.
5. If there are any conflicts, a new dialog box opens. This dialog box displays the merging options and the projects that can be merged:
   - Select Merge on import into the following project and select which project to merge with.
   - If you are not sure if you should merge the project, select Save as a new project in the library instead. The two projects will then be kept as two separate projects in the database
6. Click OK when you are ready to merge or save the two projects.

3.6 Deleting and removing projects from the project library

In the Tobii Studio Project Library, for removing a project, you have the following options:

- deleting a project from the disk
- removing the project from the project list but without deleting it from the disk.

To delete a project from the disk:

1. Start Tobii Studio.
2. From the Projects list in the Tobii Studio Project Library, click the Delete icon on the same row as the Project you wish to delete.

3. Confirm you wish to delete the project by clicking Yes in the confirmation dialog box.

When you choose to delete the project, it will be permanently deleted from the disk

To remove a project from the project list:

1. Start Tobii Studio to view the Project Library.
2. Right-click the project you want to remove.
3. On the context menu, click Remove From Library...
4. Confirm that you want to remove the project by clicking Yes in the confirmation dialog box.

4 Designing and Recording Tests

The workflow for designing tests, performing recordings and analyzing data using Tobii Studio is as follows:

1. You start by designing and recording the test on the **Design and Record** tab
2. Under the **Replay** tab, you can view and edit the recording as well as code events
3. Different types of visualizations (Gaze Plots, Heat Maps and Clusters) can be created under the **Visualization** tab
4. Define areas of interest under the **Areas of Interest** tab
5. Calculate and display eye tracking metrics based on AOI's using the**Statistics** tab
6. Optionally, you can export the gathered data using the **Data Export** tab

In this chapter, we will focus on how to design and record tests using the **Design and Record** tab.

After you create a project and test, you start by accessing the **Design and Record** tab. This tab contains tools for:

- designing tests
- managing participant data
- performing calibrations and recording eye gaze
- media presentation data

From the Design and Record tab you can also minimize Tobii Studio to the system tray, by choosing from the main menu View > Minimize to System Tray.

Please note that the Minimize to System Tray option under the View menu is accessible on from the Design and Record tab.

4.1 Creating and editing tests

Tobii Studio tests are composed of media elements that are organized along a presentation timeline. A large number of media types are available: images, PDF documents, screen recordings, websites, movies, physical objects (using a scene camera), external video, and instruction stimuli. This facilitates studies in a range of different research fields.

4.1.1 Adding media to a test

Media is added to the test by dragging the media element from the media toolbar to the timeline. For example, you can quickly place a series of pictures, movies, or add a screen or web recording, in the same test (except when using external video and scene camera media). For more information on Tobii Studio media limitations, please read*13 Tobii Studio media limitations*).

To add a media element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface if no elements were previously added). The media setup dialog box opens.
2. Set up your media element by changing the settings in the media setup dialog box (for information on how to set up different media elements, read *4.1.2 Media element types*).
3. Click OK to accept the settings and close the dialog box.
4. The media is now visible as a slide icon in the center of the test workspace. The line behind the media element represents the timeline and the arrow represents the direction of the test. Right above the media element is the position number of that element in the current test.

4.1.2 Media element types

Tobii Studio integrates different types of media for analysis. The different media elements can also be referred to as stimuli.

Media element types (stimuli):

- Instruction: Text elements that can be used to display instructions or describe tasks to the participant.
- Image: Presents a picture or a graphic element (i.e. BMP, GIF, JPG, JPEG, TIF, TIFF, PNG).
- Movie: Presents video in AVI, WMV or ASF format (only formats accepted).
- Web: Websites added by entering the URL or web address of the website (viewed in Microsoft Internet Explorer browser).
- Screen Rec: Used to record stimuli that are presented by an external software application (or the software itself) and shown on the local screen.
- External Video: Records the video output of software, games or a program running on an external device (e.g. a second computer or TV). Requires a video capture card installed on the computer running Tobii Studio. It records the video on any external source, such as a video capture card or camera. This media element cannot be used together with other elements on the same timeline.
- Scene Camera: Used to analyze how people observe and interact with physical objects or external scenes. The scene or object is recorded by Tobii Studio through an external camera. This media element cannot be used together with other elements on the same timeline.
- Questionnaire: Allows you to create and display multiple-choice questionnaires that require a single answer during a recording. The answers can be used to filter and compare data sets in the Tobii Studio visualizations and statistics tools.
- PDF Element: Allows participants to navigate through a static PDF document and move back and forth between the pages, facilitating display of documents, print ads, newspaper spreads, and other study objects in a more natural manner of interaction.

4.1.2.1 Instruction

An Instruction element is a text element that can be used to describe a task (e.g. “four images will be shown...”) or to provide instructions to a participant during a recording (e.g. which key to click to move to the next slide). An instruction can be placed anywhere on the timeline and is displayed as text on a customizable background.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the Instruction element:

1. Type a name in the Element Name field.

To add and edit text:

1. Type the text in the Preview field (Add your text here...).
2. To the right of the field is a preview of the Instruction element.
3. Change the font and color of the text by clicking the Font... button and choosing from the color drop-down list.
4. Select the element’s background by selecting the Color option and selecting a color from the list, or by selecting the Image option and locating an image file on your computer.

To choose how the instruction element ends and moves to the next element, select one of the following options from the Properties area:

- **View time**: The Instruction screen will be displayed until the set time duration expires. To set the duration, select a predetermined time value (in seconds) in the View Time field.
- **Mouse click**: The Instruction screen will be displayed until the mouse is clicked by either the test participant or the test leader.
- **Key press**: The Instruction screen will be displayed until a key on the keyboard is pressed by either the test participant or the test leader. Click the Key press drop-down list and select a key from the list.

Select the **Show Mouse Cursor** check box to display the mouse cursor on the screen during presentation of the Instruction.

Select **Enable for visualizations** to enable eye-tracking during the presentation of the Instruction element. During the recording, an image file of the Instruction is created. This is used to create heat maps, gaze plots, AOIs and more. As a result, selecting this option will make the project larger.

4.1.2.2 Image

An Image element is a media element that is used to present image files to the participant during a recording. During the presentation, images are shown in actual size, up to the screen's current resolution.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the Image element:

1. The software uses the image file name, minus the extension, once the file is added to the element. You can change the element name by clicking in the Element Name field and replacing the name.

To add an image file to an Image element:

1. Click the Browse... button to open Windows Explorer and browse to the image file you want to add to the test.
2. Click the image file and then select Open to add the file to the Image element. A preview of the image is shown below the Image Name field. Select the Show Mouse Cursor check box if you wish to display the mouse cursor on the screen during presentation of the image.
3. If the image does not take up the entire screen, you can change the background color of the element by selecting a color from the Background color drop-down list.
4. Select the Mark as dummy media check box if you wish to exclude the image from analysis. In other words, the image will be shown during the presentation, but it will not be possible to create AOIs. gaze plots or heat map for the image.

To choose how the image element ends and moves to the next element, select one of the following options from the Properties area:

- **View time**: The Image element will be displayed until the set time duration expires. To set the duration, select a predetermined time value (in seconds) in the View Time field.
- **Mouse click**: The images will be displayed until the mouse is clicked by either the test participant or the test leader.
- **Key press**: The images will be displayed until a key on the keyboard is pressed by either the test participant or the test leader. Click the Key press drop-down list and select a key from the list.

During the test, the image is presented in actual size, but limited to the eye tracker's screen resolution and the screen resolution settings in Windows. For example, if you are using a Tobii T60 or T120 Eye Tracker, the maximum image size is 1280×1024 pixels, while with a Tobii T60XL Eye Tracker, the maximum is 1920×1200 pixels. Images larger than the eye tracker's screen resolution will be cropped for the presentation with the center of the image remaining at the center of the screen.

Use an image-editing application to resize an image.

You can also add multiple images (as well as movies) at the same time by copying them to the test timeline directly from Windows Explorer.

To add multiple images:

1. Browse to the folder in Windows Explorer that contains the images to be added.
2. Select all the images you wish to add to the study, for example, by pressing and holding the CTRL key as you click each file.
3. Right-click the selection and in the context menu select Copy.
4. Return to Tobii Studio. Under the Design and Record tab, right-click the timeline and select Paste.
5. In the Add Multiple Images dialog box, there is a list of the file names. You can preview each file by clicking the file name. You can also add or remove files from this screen by clicking the Add... or Remove buttons.
6. Change the order of the files by selecting the file and clicking the arrow button for the desired direction (located to the right of the list).
7. Set the viewing properties in the Properties box.
8. Select Randomize Images if you wish to present the images in a counterbalanced order.
9. Click OK to add the images to the test.

For information on accuracy of the image presentation in Tobii Studio, please read *14.1 Appendix A — Tobii Studio critical timing information*

4.1.2.3 Movie

A Movie element is a media element that is used to present video files to participants during a recording. During the presentation, videos are shown in actual size and key presses and mouse clicks are also recorded.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the Movie element:

1. The software uses the video file name, minus the extension, once the file is added to the element. You can change the element name by clicking in the Element Name field and replacing it by a new name.

To add a video file to the element:

1. Click the Browse button and locate the video file you want to add.
2. Click the video file and then select Open to add the file to the Movie element.
3. Select the Mark as dummy media check box if you wish to exclude the movie from analysis. In other words, the video will be shown during the presentation, but it will not be possible to create a visualization for the video.

To choose how the movie element ends and moves to the next element, select one of the following options:

- **Movie end**: The duration of the media element presentation is set to the end of the video playback, i.e. the next element on the timeline is shown when the video ends.
- **Mouse click**: The video will be shown until the mouse is clicked. This can be done by the test participant or the test leader. Thereafter, the next media on the timeline will be shown.
- **Key press**: The video will be shown until any key on the keyboard is clicked. This can be done by the test participant or the test leader. Thereafter, the next media on the timeline will be shown.

Select the Show Mouse Cursor check box if you wish to display the mouse cursor on the screen during presentation of the video.

During the test, the video is presented in actual size, but limited to the eye tracker's screen resolution and the screen resolution settings in Windows. For example, if you are using a Tobii T60 or T120 Eye Tracker, the maximum video size is 1280×1024 pixels, while with a Tobii T6närlivs förturXL Eye Tracker, the maximum is 1920×1200 pixels. Videos larger than the eye tracker's screen resolution will be cropped during the media element's presentation. Use a video-editing application, such as Adobe Premiere or VirtualDub to resize a video.

A video media file generally consists of a video data package containing a video header block and a video data block. This type of file format is often called a container or wrapper (e.g. AVI is a commonly used container for video media in Windows). The videos added to a Tobii Studio test must be in AVI or ASF format.

AVI (Audio Video Interleaved)is a multimedia container format introduced by Microsoft in November 1992 as part of its Video for Windows technology. AVI files contain both audio and video data, as well as information on audio-video synchrony. The first frame in each recording is time-stamped and the remaining frames are recorded without timestamp information. AVI containers often suffer from frame losses during coding and processing of video data. The absence of time-stamped frames can lead to a loss of synchrony between the audio and video streams during playback. To cope with frame losses, Tobii Studio's replay tool stretches the video tracks (by repeating some frames) to the full duration of the playback that is stored in the database. As long as the video device doesn't drop frames during the replay this approach works very well.

ASF (Advanced Systems Format, formerly Advanced Streaming Format or Active Streaming Format) is Microsoft's proprietary digital audio/digital video container format, especially intended for streaming media. ASF is part of the Windows Media framework and contains a timestamp for each media frame, facilitating media synchronization, even in situations when frames have been dropped during recording. In this case, synchronization will still be maintained as good as possible by trying to match each frame timestamp with the data timestamp. The frames that are dropped are replaced by the previous frame during playback of the recording.

The video data block contains video and audio and can be encoded using different codecs. A codec is software or a device capable of encoding and decoding video data In Tobii Studio, this process is accomplished using Microsoft Windows' media framework DirectShow. DirectShow is a multimedia framework and API (programming interface) responsible for performing various operations with media files or streams in a Windows environment, such as encoding or decoding some common media file formats. Microsoft Video 1 and MP3 are standard codecs installed on all Microsoft computers. The Tobii Studio installation includes the Techsmith codec. If you wish to use other codecs, you must ensure that the correct video codecs are installed.

Tobii Studio does not support the use of codec packages.

For information on accuracy of video presentation in Tobii Studio, please read *14.1 Appendix A — Tobii Studio critical timing information*

4.1.2.4 Web

The Web media element is used to display webpages to participants during a recording. In order to use this element during a recording, your computer needs to be connected to the Internet or the websites need to be stored locally on your computer. Tobii Studio uses the website's URL or a local address to open the site in Internet Explorer and automatically records all mouse clicks, key strokes, and webpages visited during the test.

Currently, Internet Explorer is the only browser supported by Tobii Studio's Web element.

Please note that Windows 8.0 and Internet Explorer 10 are not supported(Please see the below illustration for Internet Explorer and Windows compatibility).

Tobii Studio will automatically choose the Web Recorder Plug-in based upon your setup (If you have Internet Explorer 9 or older you will have the old plug-in selected, if you have Internet Explorer 11 then the new plug-in will be selected).

	Windows 7	**Windows 8**	**Windows 8.1**
IE11	Supported	Not Supported	Supported
IE10	Not Supported	Not Supported	Not Supported
IE9 and below	Supported	Not Supported	N/A (IE 9 is not available on Windows 8.1)

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the Web element:

1. The software uses "Web Element" as the default name. You can change it by clicking in the Element Name field, deleting the existing text, and typing a new name.

To add a start URL and change the browser settings:

1. Click the Start URL field and type a URL or a local computer address (you do not need to type http://).
2. Select whether you want to launch the browser using a fixed browser size or in full-screen mode. Skip steps 3 and 4 if you select Fullscreen.
3. Set the browser's starting location on the screen by typing values in pixels. The top-left point of the screen has the coordinates (0, 0), and the browser's origin is the top-left point of the browser window. For example, by typing Left=0 and Top=0, the top-left corner of the browser is in the top-left corner of the screen.
4. Type the width and height of the browser window in pixels.

To specify how to stop the Web element recording:

1. Select the End recording after check box to set a time limit for the Web element session (in seconds). This is calculated from the moment the screen recording starts. Please take into consideration that, depending on how long it takes for the browser to start up and for the page to load, the time the participant gets exposed to the stimuli varies.
2. If you choose not to select End recording after, you end the web element and move to the next media element on the timeline by pressing F10 on your keyboard.

Please note that F10 and Esc are the default keys for moving to the next element and aborting the recording. You can change those from the Tobii Studio main menu by choosing Tools > Settings and selecting the Recording tab.

If you press the escape key during a recording, the recording is aborted and the next element will **not** be presented.

Since not all web pages are fully compatible with Internet Explorer 8, before starting the recording you need to set Internet Explorer 8 to run in compatibility mode.

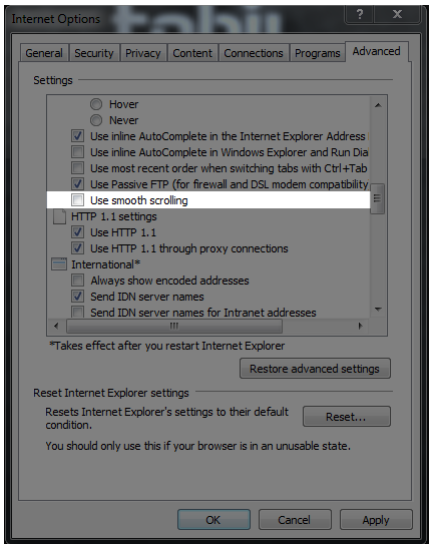
To turn on the Internet Explorer 8 compatibility mode:

1. Open Internet Explorer.
2. Click the Tools menu and then select Compatibility View Settings.
3. In the Compatibility View Settings dialog box, select the option "Display all websites in Compatibility View".
4. Click Close to accept the changes and close the dialog box.

Disabling smooth scrolling in Internet Explorer:

It is recommended to disable "Smooth Scrolling" within Internet Explorer unless it is absolutely necessary to use it, to do this simply follow the below steps:

1. With an Internet Explorer window open click Internet Options to open the Internet Options dialog box.
2. Click on the Advanced tab and scroll down within the settings sub-window to the "Browsing" section.
3. Locate the Use smooth scrolling check box and make sure it is deactivated/clear.



4.1.2.5 Screen Recording

The Screen Recording media element is used to record the screen and gaze activity of the participants when using an application on the computer running Tobii Studio. It is intended for use with low-intensity graphics applications such as word processors or PowerPoint. For applications that are more graphic-intensive, such as high-quality movies or computer games, use the Movie or External Video media element instead. During a screen recording, the participant is free to use any type of application on the computer.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the Screen Recording element:

1. The software uses "Screen Recording Element" as the default name. You can change it by clicking in the Element Name field, deleting the existing text, and typing a new name.

To select the application you want to test:

1. Optionally select the Run command check box (this check box is automatically checked when the path for the executable file is entered either by typing the target path or by clicking the Browse button and select the executable file). Type the target path of the executable file of the program you want to run, or click the Browse... button to open Windows Explorer and select the executable file or program you want to run. This step is optional.
2. Type the path of the folder where the executable file is located in the Start in: field. This step is optional.
3. When the Run command check box is checked, two more settings become available. Select End screen recording when external application is closed to stop the Screen Recording element when the participant exits the application. Or select Close external application when screen recording ends. In this case, the element is ended by pressing F10 on your keyboard or aborting the recording with ESC. You can change the key to be used for stopping the media element in the Global Settings window (Tools > Settings). If none of the options above are selected, the element is ended with F10 and the application is closed separately.
4. If the Run command is left unchecked, the application has to be started by the test participant or the test leader. When the recording starts, Tobii Studio is minimized and the Windows desktop or any program that is opened on the desktop is displayed.

If the Run command is not selected, press F10 to move to the next element or ESC to abort the recording.

While the Screen Recording element is active, Tobii Studio records gaze data, a video of the screen content, keystrokes, and mouse clicks. The video is recorded in the screen's resolution.

4.1.2.6 External Video

The External Video media element is used to present and record video and sound from an external device. Tobii Studio records the video input from these devices as a video file. Please note that separate hardware is needed in order to be able to use this feature. This media element cannot be combined with other elements in the timeline.

The External Video media element type is recommended for presenting stimuli that have complex graphics or are resource-intensive applications, such as video games, interactive television, stimulus presentation software (such as E-prime) and computer games played on another computer.

The recordings are made via:

- Analog video capture cards for VCR input
- VGA or DVI capture cards for input from another computer or other digital sour ce
- VGA-to-USB converter to capture VGA signal from another computer via USB (should be used only with low resource graphics applications)
- FireWire for digital cameras
- USB streaming from video or web cameras

Before adding the External Video element to a test, make sure the hardware is set up properly. The video source needs to be connected with a video capture card, FireWire cable, or USB cable to the computer where Tobii Studio is running. Install the correct drivers and codecs on the computer to avoid possibly compromising recording performance.

Please refer to the Tobii System Requirements & Recommendations document (available at www.tobii.com) or contact Tobii support for information on recommended video capture cards and setups.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the External Video element:

1. The software uses "External Video Element" as the default name. You can change it by clicking the Element Name field, deleting the existing text and typing a new name.

To set the video source and properties:

1. Choose the video source by selecting a device form the Video Source drop-down list.
2. If the device has more than one input (e.g. S-video and composite), specify the input you want to use for the video recording by selecting it in the Inputs drop-down list.

3. Choose the codec you want to use to convert and/or compress the video signal during the recording by selecting an option from the Video Codec drop-down list. The choice of codec will impact the video quality, file size, and CPU load during recording. For most purposes, the Microsoft Video 1 codec is recommended.
4. Click the Settings... button to set the Temporal Quality Ratio of the video compression. The higher the quality ratio, the better the video quality will be but the more CPU resources will be consumed.
5. Click Edit... to enable codecs. Select the codec from the disabled list and click the left direction arrow to add the codec to the Video Codec drop-down list. Do the opposite to remove a codec.
6. Click the Preview box to preview the video streamed from the device.

To set device-specific settings:

1. If your external device is a video camera, click Camera Settings to change the video image settings, such as brightness and contrast.
2. Click Video Settings to change other device-specific hardware settings, such as video size and frame rate.

To display the video input live on the screen of the computer running Tobii Studio (and connected to the eye tracker), during the recording:

1. Select the Use video as stimulus check box.

In most cases when capturing video, the video signal needs to first be converted from analog to digital. It then needs to be captured and compressed into a movie. Because of this process, delays may occur, affecting the precision of the video synchronization. At high CPU load, some video capture devices occasionally drop video frames. This means that although gaze data and trigger data are timed with the same precision as for all other Tobii Studio media types, the synchronization of gaze data in relation to the captured video may be degraded. Make sure you use a high-performance computer.

Recommended computers, video capture cards, and codecs can be found in the system recommendations document (available at www.tobii.com).

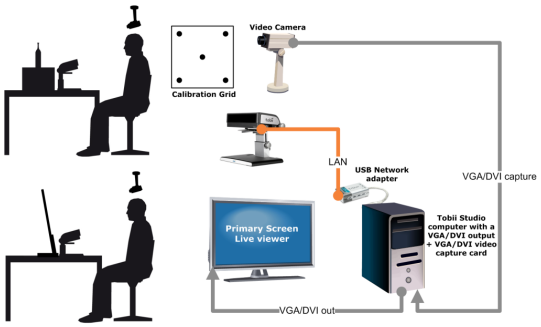
Please refer to the eye tracker hardware documentation for more information on the possible setups.

4.1.2.7 Scene Camera

The Scene Camera media element is used in combination with Tobii X-Series Eye Trackers setups. It combines video data collected from a stand-alone camera and gaze data. In addition to the video device settings, the Scene Camera element contains a perspective calibration tool to compensate for the scene camera's position relative to the stimulus and the user. This media element cannot be combined with other elements in the timeline.

The typical setup consists of the following items:

- **Some sort of physical stimulus**, such as a collection of objects that is moved around on a table or magazines, mobile devices or similar. For proper gaze recording, stimuli should be positioned or moved along a 2-dimensional plane. Any deviations from the plane caused by the depth of the objects placed on the plane, for example, will cause parallax errors in the gaze estimate.
- **A calibration grid**, which is placed on the same surface that is being tracked. This grid is used to calibrate the eye tracker to the participants and to align the calibration of the scene camera perspective.
- **A scene camera** (a video camera or a webcamera), which is used to record a video stream of the scene presented to the test participant. The video from the scene camera is recorded in Tobii Studio.
- **A Tobii X—Series Eye Tracker** and the correct settings in the configuration tool. For details on the eye tracker setups and settings, read the system recommendations document and the Tobii Eye Tracker User Manual
- A computer with Tobii Studio Professional or Enterprise



Before adding the Scene Camera media element to the test, make sure the hardware is set up properly. The video source needs to be connected to a video capture card, FireWire or USB port on the computer where Tobii Studio is running. Please refer to the system recommendations document (available for download at www.tobii.com) or contact Tobii Support for information on recommended video capture cards and setups.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the media element:

1. The software uses "Scene Camera Element" as the default name. You can change it by clicking the Element Name field, deleting the existing text, and typing a new name.

To set the video recording source and properties:

1. Choose the video source by selecting a device form the Video Source list
2. If the device has more than one input (e.g. S-video, composite), specify the input you want to use for the video recording by selecting it in the Inputs list
3. Choose the codec you want to use to convert and/or compress the video signal during the recording by select a codec from the Video Codec list. The choice of codec will impact the video quality, file size, and CPU load during recording. For most purposes, the Microsoft Video 1 is recommended.
4. Click the Settings... button to set the temporal quality ratio of the video compression. The higher the quality ratio, the more detailed the recording will be. However, the recording will also consume more CPU resources.
5. Click Edit... to select which codecs are enabled. These codecs are then shown in the Video Codec list.
6. Click the Preview box to preview the image streamed from the device.

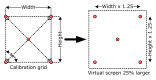
To set device-specific settings:

- If your external device is a video camera, click Camera Settings to change the video image settings, such as brightness and contrast.
- Click Video Settings to change other device-specific hardware settings, such as video size and frame rate.

In most cases when making a video recording, the video signal needs to be converted from analog to digital. This is done by using codecs. Because of this, delays are induced affecting the precision of the video synchronization. Furthermore, at high CPU load, some video capture devices occasionally lose video frames. This means that although gaze data and trigger data are timed with the same precision as for all other Tobii Studio media types, the synchronization of gaze data in relation to the scene camera video may be degraded. **Make sure you use a high performance computer.**

Since the stimulus that is being eye-tracked is a physical object, the calibration points need to be displayed on a separate calibration grid. The calibration grid must have the same shape as the calibration pattern used in Tobii Studio and include either five or nine dots. The calibration dots can be drawn on a paper, marked on a calibration board, or on the object itself.

It is also good to include a 25% larger active display area around the grid to make it easier to measure the parameters required in the X Series Configuration Tool (for details, please read the Tobii X—Series Eye Tracker User Manuals). Make sure that the corners of the calibration grid are exactly 90 degrees and that the center point is exactly in the middle of the grid. How to calculate the 25% larger active display area, which needs to be added in the X Series Configuration Tool, is described in the figure below.



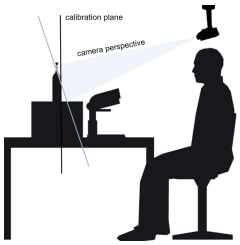
All values in the X Series Configuration Tool must be measured and added correctly to ensure data accuracy (see the Tobii X—Series Eye Tracker User Manual for more information).

To access the X Series Eye Trackers Configuration Tool in Tobii Studio:

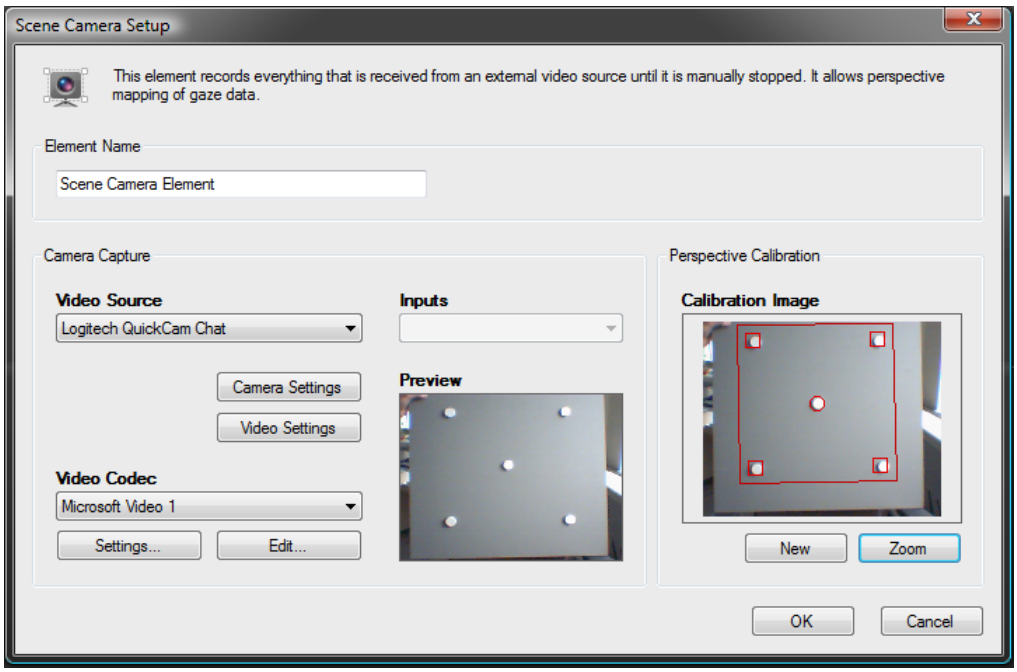
1. Click the Tools menu and select Settings.
2. In the Global Settings dialog box, click the Eye Tracker tab, select the eye tracker from the list and click the X Config Tool... button.

To compensate for the scene camera perspective:

1. Use the Preview image to adjust the camera's position so that it shows an image of the surface and the calibration grid you want to eye-track and then secure the camera to avoid any accidental shift in position.
2. Place the calibration grid on the object's surface



3. In the Perspective Calibration section, click New. A snapshot of the camera video feed is shown in the Calibration Image box along with a polygon with five calibration points.



4. Adjust the five points of the polygon so that their positions match the position of the five dots on the calibration grid. Do so by dragging each point over the respective calibration grid dot. To ensure that the points are placed correctly over the calibration dots, click the Zoom button to open the Calibration Image dialog box containing an enlarged version of the calibration image.
5. Click OK to accept the changes and close the dialog box.
6. Set the calibration to manual. For details on manual calibration, please read *4.3.1.2 Manual calibration*

During the recording, Tobii Studio records the video feed from the scene camera, gaze data, keystrokes, and mouse clicks. The gaze data X and Y coordinate space corresponds to the calibration grid area, where its values range from (0,0)— top left corner — to the image size of the scene camera video. You can get negative values if looking up and to the left

The perspective calibration is intended to compensate for the difference in angle between the participant's perspective of the calibration grid and the scene camera. However, this only compensates for angles on the stimulus plane. If three-dimensional physical objects are used as stimuli and these have a certain height or depth that takes them far away from the stimulus plane, this will cause a parallax error. The size of this error is related to the difference in point of view from the scene camera and the test participant.

To minimize parallax errors, it is therefore recommended that you place the scene camera at an angle fairly close to that of the test participant, such as slightly behind and to the side of the participant or immediately over the participant's head.

4.1.2.8 Questionnaire

The Questionnaire media element is used to present multiple choice questions to which the participant may only select one answer. The answers to the questionnaire can later be used as independent variables, which can be used to filter the eye tracking data for visualizations and descriptive statistics reports. It records also key presses and mouse clicks.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the Questionnaire element:

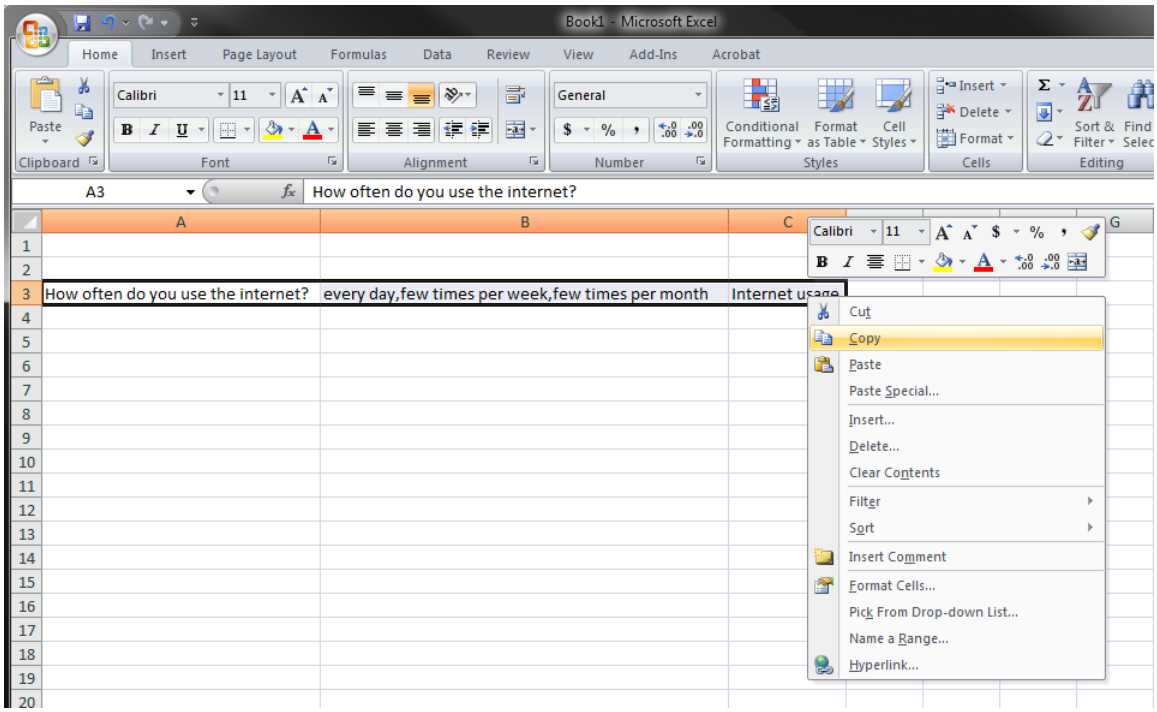
1. The software uses "Questionnaire Element" as the default name. You can change it by clicking in the Element Name field and replacing the name with a new one.

To create a Questionnaire element:

1. Click the Add Question button to open the Question Setup dialog box.
2. In the Question field, type the question you want the participant to see.
3. Add the multiple choices to the Answers section, by selecting Create new or Use values from existing Independent Variable:
   - After selecting the Create new radio button, type the desired variable name. Click the first row in the Answers list box twice so that the cursor blinks and type one of the answer texts. Press ENTER and click the next row to add another answer.
   - After selecting Use values from an existing Independent Variable, choose the variable from the Variable Name drop-down list. These variables are managed under the Independent Variables tab of Manage Participants, but can be edited for the questionnaire.
4. Change the order of the answers by selecting the answer to move and clicking the arrow button for the desired direction (located to the right of the list).
5. Click the Preview button to preview the question.
6. Click Close to save the question and return to the Questionnaire element setup dialog box.
7. If desired, add more questions to the same element by repeating steps 1-7. Each question with answers will be displayed on its own slide.
8. To change the order of the questions, select the question to move and click the arrow button for the desired direction (located to the right of the Question list).
9. Click the Edit button to modify the question, or click the Delete button to delete it.
10. Click OK to save and close the Questionnaire element setup dialog box or click Cancel to discard the changes and close the dialog box.

To copy one or more questions from Excel to the Questionnaire element:

1. In Excel, type the question text in the first column.
2. In the same row, type the answers, separated by a comma and space, in the second column.
3. Type a name for the variable in the same row, in a third column.
4. Select the three cells and copy them, as shown below:



1. In the Questionnaire element setup dialog box in Tobii Studio, click in the Question list frame.
2. Use your keyboard shortcut keys to paste (CTRL+V) the question into the Questions list. Multiple rows of questions can be added from Excel at the same time.

4.1.2.9 PDF

The PDF media element is used to display PDF documents, facilitating the display of magazine spreads, printed ads, newspaper spreads and other documents that can be converted to PDF. The PDF element allows participants to navigate through the PDF document, using the left and right key to move back and forth between the pages, in a very natural way of interaction. Interactive features such as links are not supported by the PDF element. It records also key presses and mouse clicks.

To add the element to the test:

1. Drag the media element icon to the test workspace/timeline (indicated by the gray arrow in the user interface). The media setup dialog box opens.

To name the PDF element:

1. The software uses “PDF Element” as the default name. You can change it by clicking in the Element Name field, deleting the existing text, and typing a new name.

To add a file to the PDF element:

1. Click the Browse button to open the Open dialog box.
2. Locate the PDF file you want to add and click it.
3. Click Open to add the file to the element screen. A preview of the document is shown below the PDF file name field.
4. Specify whether the PDF should be presented as single-paged or as double-paged side-by-side (Magazine).
5. Skip this step if you have selected Single paged. Select the Show front page as single page check box to display the first page of the PDF as a single page, or as a book cover.
6. Click the Advanced... button to open the PDF Advanced Settings dialog box to change the background color and to select whether or not to Show page numbers during the PDF presentation (select Show page numbers). This step is optional.

To choose how the PDF element ends and moves to the next element, select one of the following options:

- Browse until last page: The element will be displayed until the test participant reaches the last page of the PDF.

- Browse until F10 or ESC is pressed: The PDF is displayed until F10 is pressed. Thereafter, the next media on the timeline will be shown. If ESC is pressed, the recording is aborted.

  Please note that F10 and Esc are the default keys for moving to the next element and aborting the recording. You can change those from the Tobii Studio main menu by choosing Tools > Settings and selecting the Recording tab.

- Time limited: The PDF element is displayed for a certain amount of time (in seconds). The display time can be changed by typing or selecting a time value in the Time limited box.

By default, Tobii Studio displays the PDF document in actual size (Zoom %: 100). It may therefore happen that the size of the PDF document does not match the test screen's size, and if presented in actual size, some parts of the document will not be displayed. Use the Size options to adjust the PDF size for optimal viewing.

To set the PDF document size:

1. Under Size, on the PDF Element Setup screen, select the Zoom option to manually set the size of the PDF as a percentage of the original, or select Scale to Screen Resolution to automatically have the size set to match the screen resolution.
2. Click the Preview button in the lower-left corner of the Setup screen to see how the stimuli will be presented during the test.
3. Press ESC on the keyboard to exit the preview. If the size is not ideal, repeat the two previous steps.

After performing a recording, every page (single or double paged) in the pdf document will be available for analysis in the Visualizations and in the Areas Of Interest views in Tobii Studio.

4.1.3 Editing an existing test

After adding elements to the test timeline, you can change the initial test design by easily deleting or editing existing media elements.

If recordings have been performed with the test, the test is locked and you have to unlock the test by clicking on the red lock button on the upper right corner of the window. A confirmation dialog displays asking you if you want to unlock the test. Click Yes to unlock the test in order to be able to edit it.

To delete a media element:

1. Right-click the media element.
2. Select Delete from the context menu.
3. Click OK in the confirmation dialog box if you are sure you want to delete the element.

To copy a media element:

1. Select the media element(s) to copy. To select multiple media elements, click and hold the CTRL key while you click each media element. To select many consecutive elements, click the first element in the sequence and then press and hold the SHIFT key while clicking the last one. All the elements between the two clicks are selected, including the two clicked.)
2. Right-click the media element.
3. Select Copy from the context menu.
4. Click the media element in the timeline that you would like to paste after (to the right of), right click and select Paste from the context menu.

To change the position of a media element in the timeline:

1. Select the media element or elements.
2. Drag the media to the new position on the timeline.

To edit the media element presentation properties:

1. Right-click the media element
2. Select Edit in the context menu. The Media Element Setup dialog box opens.

3. Make the necessary changes to the media element.
4. Click OK to accept the changes and close the dialog box.

4.1.4 Presentation Sequences

Presentation Sequences makes it possible to decide the order of timeline elements shown in a recording. This means that it is possible to show all or just some of the elements on the timeline in a selected, predefined order to a participant in a study during a single recording. The only limitation to the order definition is that the same element cannot be shown more than once in the same recording.

If you want to show different media elements to different participants, such in an A/B test, you can now add these to the same timeline instead of creating one test per media element. This is possible because not all elements on the timeline, i.e. media, have to be included in the all Presentation Sequences you create. Hence, you can now instead create one sequence per media version. By keeping all media versions in the same test you can more easily compare them when doing data analysis as you don't have to switch test to access the data.

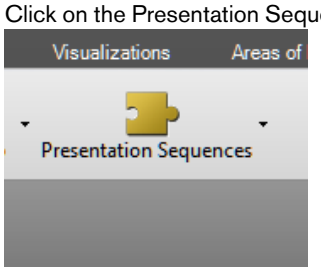
To specify the different versions of the timeline that will be used in the test, a file that outlines the permutations of the element presentation order must be created. The permutations have to be given unique names that later can be selected when doing the recordings. In Tobii Studio each permutation of the timeline will be called a "sequence" as it is a sequence of elements from the timeline.

Element types that cannot be used in Presentation Sequences are External Video and Scene Camera elements.

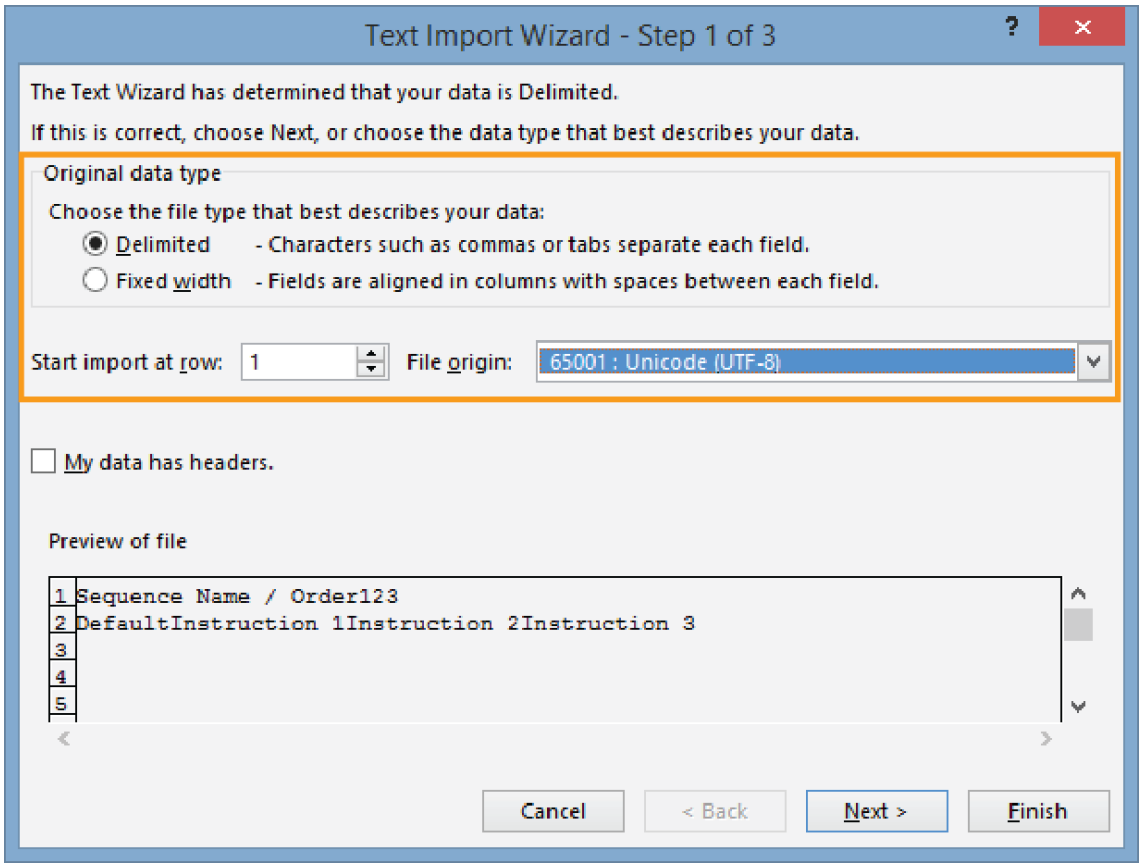
4.1.4.1 Exporting and importing Presentation Sequences

In order to create sequences to use, please follow this workflow:

1. Add the elements to the timeline you want to use in your test. The timeline will act as your library of media elements. Ensure you give each element a unique name as the name will be used to identify the element in the imported Presentation Sequences.
2. Click on the Presentation Sequences icon in the Tobii Studio toolbar to open the Presentation Sequences menu.



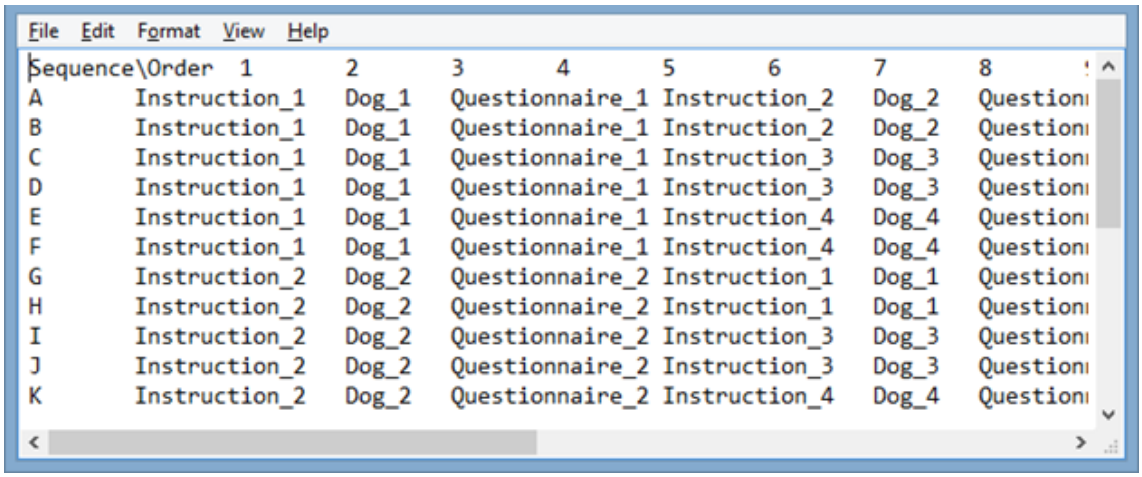
3. Select "Export..." and save your file to a location where you can easily find it. This file will contain the Presentation Sequences currently active in the system, i.e. currently imported and selectable for recordings. If you have not imported any before, the file will only contain what is shown on the timeline.
4. Open the exported file in a text editor of your choice. A recommended option for editing the file is to use Microsoft Excel as Excel will help preserving the formatting and allows for quick and easy copy/pasting of elements to new sequences. If opening the file in Microsoft Excel, you will be presented with a choice of what format best describes your data. Select the "Delimited" option. You also need to provide some information about the file in the "File origin" drop down list. Select the option "65001: Unicode (UTF-8)" in order for the file to import correctly. Once these selections have been made, click "Finish" to complete opening the file.


Text Import Wizard - Step 1 of 3
The Text Wizard has determined that your data is Delimited.
If this is correct, choose Next, or choose the data type that best describes your data.
Original data type
Choose the file type that best describes your data:
Delimited - Characters such as commas or tabs separate each field.
Fixed width - Fields are aligned in columns with spaces between each field.
Start import at row: 1
File origin: 65001 : Unicode (UTF-8)
My data has headers.
Preview of file
1 Sequence Name / Order123
2 DefaultInstruction 1Instruction 2Instruction 3
3
4
5
Cancel
< Back
Next >
Finish

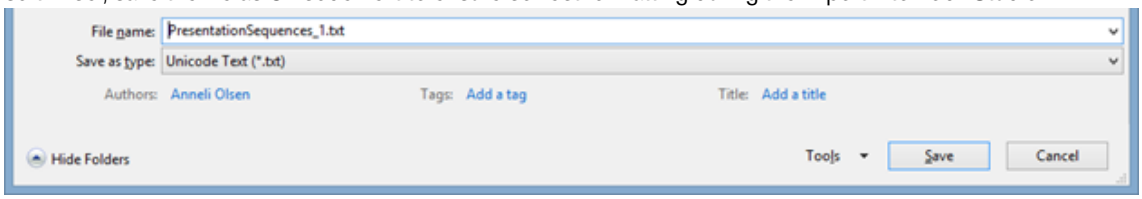
5. The first row in the file is used to show the positions available for the elements. The subsequent rows start with the name of the sequence in the first position and continues with the element names of the elements to be included in that sequence. Each row represents one sequence, i.e. element order. Create as many sequences as you want to use for your recordings. Each sequence can be used for multiple recordings. Ensure that you give each sequence a unique name.
MSExcel format:

	A	B	C	D	E	F	G	H	I	J
1	Sequence\Order	1	2	3	4	5	6	7	8	
2	A	Instruction_1	Dog_1	Questionnaire_1	Instruction_2	Dog_2	Questionnaire_2	Instruction_3	Dog_3	Questionna
3	B	Instruction_1	Dog_1	Questionnaire_1	Instruction_2	Dog_2	Questionnaire_2	Instruction_4	Dog_4	Questionna
4	C	Instruction_1	Dog_1	Questionnaire_1	Instruction_3	Dog_3	Questionnaire_3	Instruction_2	Dog_2	Questionna
5	D	Instruction_1	Dog_1	Questionnaire_1	Instruction_3	Dog_3	Questionnaire_3	Instruction_4	Dog_4	Questionna
6	E	Instruction_1	Dog_1	Questionnaire_1	Instruction_4	Dog_4	Questionnaire_4	Instruction_2	Dog_2	Questionna
7	F	Instruction_1	Dog_1	Questionnaire_1	Instruction_4	Dog_4	Questionnaire_4	Instruction_3	Dog_3	Questionna
8	G	Instruction_2	Dog_2	Questionnaire_2	Instruction_1	Dog_1	Questionnaire_1	Instruction_3	Dog_3	Questionna
9	H	Instruction_2	Dog_2	Questionnaire_2	Instruction_1	Dog_1	Questionnaire_1	Instruction_4	Dog_4	Questionna

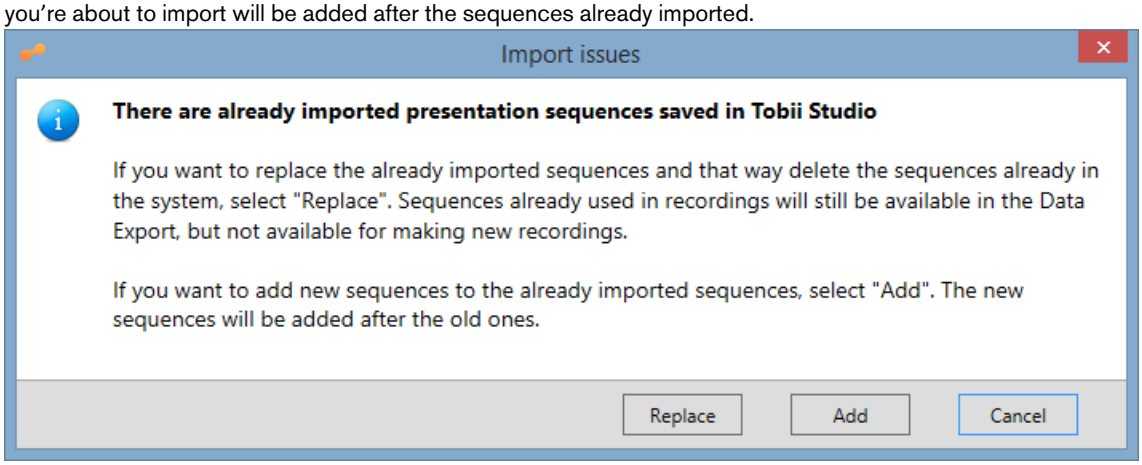
Text Format:


File Edit Format View Help
Sequence\Order 1 2 3 4 5 6 7 8
A Instruction_1 Dog_1 Questionnaire_1 Instruction_2 Dog_2 Questioni
B Instruction_1 Dog_1 Questionnaire_1 Instruction_2 Dog_2 Questioni
C Instruction_1 Dog_1 Questionnaire_1 Instruction_3 Dog_3 Questioni
D Instruction_1 Dog_1 Questionnaire_1 Instruction_3 Dog_3 Questioni
E Instruction_1 Dog_1 Questionnaire_1 Instruction_4 Dog_4 Questioni
F Instruction_1 Dog_1 Questionnaire_1 Instruction_4 Dog_4 Questioni
G Instruction_2 Dog_2 Questionnaire_2 Instruction_1 Dog_1 Questioni
H Instruction_2 Dog_2 Questionnaire_2 Instruction_1 Dog_1 Questioni
I Instruction_2 Dog_2 Questionnaire_2 Instruction_3 Dog_3 Questioni
J Instruction_2 Dog_2 Questionnaire_2 Instruction_3 Dog_3 Questioni
K Instruction_2 Dog_2 Questionnaire_2 Instruction_4 Dog_4 Questioni

6. Once the sequences have been created, save the file in a tab separated format (either as a .txt or .tsv-file). If using Microsoft Excel, save the file as Unicode Text to ensure correct formatting during the import into Tobii Studio.



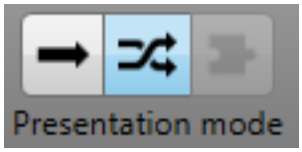
7. In Tobii Studio, click on the Presentation Sequences icon and select the “Import...” option. Select the file you want to import in the file browser that opens. If you previously have imported Presentation Sequences you will be presented with the option to “Replace” or “Add”. If you select “Replace” all previously imported sequences will be deleted and replaced by the ones in the file you’re about it import. Recordings made with deleted sequences will still be available for analysis, but you will not be able to make new recording using those sequences. If you select “Add”, the sequences in the file you’re about to import will be added after the sequences already imported.


Import issues
There are already imported presentation sequences saved in Tobii Studio
If you want to replace the already imported sequences and that way delete the sequences already in the system, select "Replace". Sequences already used in recordings will still be available in the Data Export, but not available for making new recordings.
If you want to add new sequences to the already imported sequences, select "Add". The new sequences will be added after the old ones.
Replace
Add
Cancel

8. Tobii Studio will now import the sequences defined in the file you have selected. If any issues with the file or the sequences within it is detected during import, you will get information about this in a dialogue window. The issues can either be severe enough for the import not to be able to complete or of a kind that the import procedure itself can amend. It is possible to save a text file describing the issues which can help you address them before you try to import the file again.
9. Once the import is completed you will get a notification telling you how many sequences were imported successfully and how many sequences are currently available for use when making new recordings.

4.1.5 Counterbalancing the presentation order of media elements

When Counterbalance mode is selected it is possible to use counterbalancing for all or some elements on the timeline via the Right click menu. If the mode is deselected, the element settings will be remembered until the next time this mode is selected. This option can be used if there are two or more elements on the timeline.



The Counterbalance mode feature in Tobii Studio allows you to counterbalance the presentation order of the media elements during the recordings. Tobii Studio does this by arranging the media elements selected for counterbalancing – according to a Latin Square method – and holding all other media elements in their fixed position.

The Latin Square method allows you to control for order effects introduced by the media presentation order and position, by ensuring that:

- Each recording contains every media element.
- With the appropriate number of recordings, every media element can be found in all possible positions (1^{st}, 2^{nd}, ..., i^{th}).
- Each media element is followed by each of the other media elements the same number of times.

Further down in this section, there is a detailed description of the Latin Square design implementation in Tobii Studio.

To counterbalance for presentation order for an even number of media elements, the number of recordings should be equal to, or a multiple of the number of counterbalanced media elements to present the media in all possible combinations. For an odd number of media elements you need to use twice as many, or a multiple of "twice as many", recordings as media elements to present the media in all possible combinations.

To counterbalance the presentation order between two or more media elements:

1. Right-click the media elements you want to counterbalance.
2. Select Counterbalance on the context menu.
3. Repeat steps 1 and 2 for the other media elements you wish to randomize.
4. Or right-click the media timeline and select Randomize all to randomize all the media elements on the timeline.

To counterbalance the presentation of all the elements on the timeline, right click on one element and choose Counterbalance presentation.

To remove the counterbalancing:

1. Right-click the media element.
2. Click Counterbalance to remove the check mark. The media is now deselected from the counterbalancing procedure.

If you only select counterbalancing of one media element, no counterbalancing will take place. If you choose to quit a recording while you are performing a test, the next recording will use the next sequence for the media presentation.

4.1.5.1 Tobii Studio Latin Square implementation

The Randomize feature uses a Latin Square method to construct **x** number of sequences of the presentation, depending on **n** number of media selected to be randomized. If **n** is even **x=n** and if **n** is odd **x=2n**. Each Latin Square sequence $\mathbf{x_n}$ is translated into a recording. To conduct a fully counterbalanced study, the number of recordings must be equal to **x** or a multiple of **x**. If not enough participants can be tested, the study is still pseudo-randomized but not fully counterbalanced.

Latin Square procedure:

If the number of treatments is even, then the first sequence of the Latin Square is calculated as follows:

1, 2, n, 3, n – 1, 4, n – 2, 5, n – 3, ..., i, n-i

where the sequence 1, n, n – 1, n – 2, n – 3, ..., n-i alternates with the sequence 2, 3, 4, 5, ..., i

For example, with n = 4 media elements, the first sequence of the Latin Square is:

Recording 1 = 1 2 4 3 (each number represents a media element)

Since the number of media elements is even, n=4, then the number of sequences needed is equal to x=4. The remaining sequences are obtained by adding 1 to each value in the previous sequence. In this example, if the value is 4 in the first sequence, the next sequence will have the value of 1.

In this example, we thus obtain the following sequences:

	4 x 4 Square
Recording 1	1 2 4 3
Recording 2	2 3 1 4
Recording 3	3 4 2 1
Recording 4	4 1 3 2

We see that in this Latin Square, media element 1 follows immediately after media elements 2, 3, and 4, one time each. Similarly, media element 2 immediately follows media elements 1, 3, and 4, one time each; media element 3 immediately follows media elements 1, 2, and 4, one time each; and media element 4 immediately follows media elements 1, 2, and 3, one time each.

If the number of media elements is odd, we need to create twice as many sequences as media elements (**x = 2n**) in order to present the media in all possible positions. We first start by following the same equation as when the number of media elements is even and go through the n sequences. When this is done, we reverse the first set of sequences to create a second set.

For example, when 5 media elements are randomized, the first sequence of the first set is equal to 1, 2, 5, 3, 4 and the first sequence of the second set is equal to 4, 3, 5, 2, 1 (where each number represents a media element).

	5 x 5 Square
Recording 1	1 2 5 3 4
Recording 2	2 3 1 4 5
Recording 3	3 4 2 5 1
Recording 4	4 5 3 1 2
Recording 5	5 1 4 2 3

	5 x 5 Square
Recording 6	4 3 5 2 1
Recording 7	5 4 1 3 2
Recording 8	1 5 2 4 3
Recording 9	2 1 3 5 4
Recording 10	3 2 4 1 5

The reason for doubling is that we need to make sure that each media element is followed by each of the other media elements the same number of times to counterbalance for order effects. In the first set, media element 2 is followed by 3 twice and by 5 twice, but isn't followed by 1 or 4 at all. Therefore, the second set is created and 2 is followed by 1 twice and by 4 twice.

4.1.6 Unlocking Tobii Studio Tests for editing

After you have performed a recording, the test will become locked. This is to prevent any accidental modifications during the test sessions. If you want to modify the test, you first need to unlock it.

To unlock the test:

1. Click the lock icon located in the upper-right part of the media element toolbar.
2. Click Yes in the confirmation dialog box to confirm the procedure.

4.1.7 Test preview

The Preview Test feature allows you to preview the media elements on the timeline as if it was a real recording, but without recording any data. This way, you can verify that the media elements are set up correctly with the right content and settings, and that the transitions between the different elements are as desired.

To preview a test:

1. To preview the test starting with the first element, click the Preview Test button, located next to the red Start Recording button at the bottom of the window,. If you wish to start previewing the test from a specific element and onwards, right-click that element on the timeline and select Preview Test from the context menu.
2. You can press the F10 key to move on to the next media element or press the ESC key to end the preview.

Please note that F10 and Esc are the default keys for moving to the next element and aborting the recording. You can change those from the Tobii Studio main menu by choosing Tools > Settings and selecting the Recording tab.

To preview individual media elements:

1. Right-click the media element.
2. Select Preview Element from the context menu, or press F11.
3. Press the ESC key to end the preview.

4.1.8 Creating new tests

Tobii Studio projects can contain multiple tests, all with their own timeline. These tests can be used to present different tasks to the same participants or to present the same media in different orders, which is useful for factorial design experiments.

To create a new test:

1. Click Add Test..., after having clicked the Test drop-down button - the folder symbol, which is in the upper-left corner and displays the current test's name.
2. Type a name for the new test in the Test Name field and click Create. The description is optional.

To change between existing tests:

1. Click the Test button to see the Tests in the current project.
2. Click the test you want to work with.

To copy media elements within a test or between tests, but within the same project:

1. Under the Design and Record tab, view the test you want to copy the media element from.
2. Right-click the media element (you can have multiple elements selected before right-clicking) and select Copy from the context menu.
3. Select the test where you want to paste the media element. Right-click the media element on the timeline that is to the left of where you want to paste the object and select Paste from the context menu.

To delete an existing test:

1. Open the test you want to delete.
2. Click the Test drop-down menu and click Delete test...
3. Click Yes in the confirmation dialog box to confirm the deletion.

4.2 Managing participants and independent variables

Each Tobii Studio recording is associated with a participant and his/her respective calibration data. Participant data can be created and managed before or after the recording has been performed. This data consists of a name, which is used to identify the participant, and of user-generated independent variables such as gender and age. These variables can be used to create participant groups and filter the eye tracking data by these groups when producing visualizations or metric-based descriptive statistics.

4.2.1 Creating participants

Participant data is stored under the project level in the Tobii Studio hierarchical system. Participant information thus only needs to be entered once and a certain participant would be able to have multiple recordings and take different tests, as long as the tests belong to the same Tobii Studio project. Participant data can be exported as a tab-delimited TXT file and this file can then be imported into Microsoft Excel, or other statistical software of your choice.

To create participants before performing a recording:

1. Either go to Tools on the menu bar, click Participants, and then click Manage Participants, or, click the Setup drop-down button (next to the Test button) and then click Manage Participants.
2. In the Manage Participants dialog box, under the Participants tab, click New...

3. In the Create Participant dialog box, in the Participant Name field, type the participant's name or other form of identification that you will use to refer to the participant.
4. If you have already created independent variables and know the information about the participant, select the correct values from the drop-down list for the respective independent variables.(for information on independent variables, please read *4.2.2 Creating independent variables*)
5. Click OK to add the participant and his/her information to the participants list in the Manage Participants dialog box.

To generate an arbitrary list of participants (no information besides name):

1. In the Manage Participants dialog box, under the Participants tab, click Auto Generate...
2. Now enter the number of participants you wish to generate and click OK.
3. The participants are displayed in the participants list and are automatically named **Pn-x1** to **Pn** (where **n** is the total number of participants and **x** is the number you generated). You can add up to 500 participants at a time with this feature.

To edit an existing participant:

1. In the participants list, double-click a participant, or click the participant and then click Edit.
2. You can change the participant name or the independent variable values in the Edit Existing Participant dialog box.
3. Click OK to accept the changes.

4.2.2 Creating independent variables

Participant-independent variables and values can be generated in two different ways in Tobii Studio:

- You can directly create the variable name and values in the Manage Participants dialog box
- You can add a Questionnaire media element to the test and let the participant select the values.

In the latter case, the variable name entered in the Question Setup is the variable and the possible answers are the values, of which the participant can only select one for each question.

To add a new independent variable using the Manage Participants dialog box:

1. From the Tools menu, choose Participants > Manage Participants. The Manage Participant window opens.
2. Click the Independent Variables tab.
3. Click New...
4. In the Add New Participant Variable dialog box, type the variable name (e.g. gender) in the Variable Name field.
5. Click an empty row in the Values list until you see the cursor blinks. Type a value (e.g. male).
6. Repeat step 4 until you have entered all the values.
7. Click OK to save the variable and values to the variables list in the Manage Participants dialog box.

For more information on how to create participant-independent values using participant interaction, please read the Questionnaire media element section in *4.1.2 Media element types*).

To learn how to create participant groups and filter recordings, read *7.2.1 Using independent variables and segment groups to filter recordings* and *9.2.1 Choosing recordings*.

4.3 Calibrating and recording participants

Recordings are initiated by clicking the Start Recording button located at the bottom of the window on the Design and Record tab. In order to start a recording, you need to create a new, or select an existing participant and perform a calibration. The calibration process ensures that the eye tracker "learns" the characteristics of the participant's eyes and accurately calculates the direction of his/her gaze on the surface of the screen or object. Before starting the recording session, make sure that Tobii Studio is connected to the eye tracker and that the study design and settings are set correctly.

To check the connection status between the eye tracker and Tobii Studio:

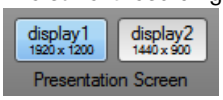
1. Below the Start Recording button there is an indicator that shows the serial number ID of the eye tracker and whether it is connected or not (Connection OK/No Connection). Click this serial number ID.

2. In the Eye tracker Selector dialog box, click the eye tracker row to select it.
3. Click OK to accept the settings and close the dialog box.

Extended desktop, dual screen setups are often used to enable a test leader to control a test using one display, while presenting the stimulus to the test participant on another. You need to first perform the necessary screen settings in Windows, as it is recommended that the eye tracker screen is set as the main display in Windows.

To configure an extended desktop, dual screen setup:

1. In the lower-left corner of the Design and Record tab, you can see the Presentation screen displays, as illustrated below. The current recording screen is highlighted by a light blue background color.



2. If you wish to change the display, click on the display that you want to be the recording screen. When you roll the mouse over the blue highlighted display, you will see a message on the respective screen — *This is the recording screen*, and for the other display you will get a message on its corresponding screen saying *Click to make this the recording screen*.
3. To enable Live Viewer, click the Setup icon and select Show Live Viewer.
4. The Live Viewer window opens on the main display. Drag the window to the display that is used to monitor the recording (read *12.1.2 Configuring a dual-screen computer setup*, to find out more on how you can configure your system to support a dual screen setup).

To check if the user camera and user sound are enabled/disabled:

1. Click the Setup icon on the Design and Record header and select Settings.
2. Under the Screen and Video Capture tab, select the Record user camera and Record user sound check boxes (read *12.2.1 Screen and video capture settings* for details on how to set the user camera and sound).

Click the Preview Test icon to verify that the media is presented correctly (read *4.1.7 Test preview* to learn how to preview a Tobii Studio test).

Make sure that you have the correct calibration settings (read the section below)

4.3.1 Calibration settings

Before an eye tracking recording is started, the user is taken through the calibration procedure. During this procedure, the eye tracker measures characteristics of the user's eyes and uses them together with an internal, physiological 3D eye model to calculate gaze data. This model includes information about shapes, light refraction and reflection properties of the different parts of the eyes (e.g. cornea and placement of the fovea). During calibration, the user is asked to look at specific points on the screen, also known as calibration dots, while several images of the eyes are collected and analyzed. The resulting information is then integrated with the eye model and the gaze point for each image sample is calculated.

The default calibration process in Tobii Studio consists of a presentation of five calibration dots on a plain, colored background. The dots are presented successively and the participant must focus his or her visual attention on the center of the dots. You can customize various features of the calibration procedure such as changing the number and color of the dots, the background color and the type of calibration stimuli, and you can also perform the calibration manually.

To access the calibration settings:

1. Click the Setup icon in the Design and Record tab.
2. Select Settings.
3. In the Global Settings dialog box, click the Calibration tab.
4. Now select a calibration type. You can choose between Regular, Manual, or Infant calibration

4.3.1.1 Regular calibration

Regular calibration is the default calibration in Tobii Studio. Other than a few specific situations, Regular calibration should be used as the standard type of calibration procedure. The default settings for Regular calibration are set to five calibration points – the color of the points is red, the background is gray, the speed is set to medium and the calibration is set to use the full screen. Presentation of the dots is sequential and fully automatic.

To change the Regular calibration settings:

1. Click the Foreground Color drop-down list and select the color for the points.
2. Set the calibration speed by selecting one of the five preset speeds in the Calibration Speed list.
3. Set Number of calibration points to 2, 5, or 9 points
4. Click the Background Color list and select the color of the calibration background screen.
5. Click Configure... to adjust the area of the screen that will be used when performing calibrations. This may provide a more accurate calibration if you are planning to use a small area of the screen to show the stimulus.

Click Restore default to reset the respective calibration settings to the default value.

4.3.1.2 Manual calibration

Manual calibration is best suited for studies using the Scene Camera media element or in cases where participants have poor vision and have problems following the points in the regular calibration. In these cases, Manual calibration provides the ability to conduct a more accurate calibration, step-by-step.

The calibration is performed after the space bar is pressed. Make sure that the test participant doesn't move his/her gaze at the sound of the space bar press.

To change the Manual calibration settings:

1. Click the Foreground Color drop-down list and select the color for the lines forming the calibration cross.
2. Select Show manual calibration instructions to view the calibration instructions before the calibration procedure begins. Uncheck the check box to hide the instructions.
3. Set Number of calibration points to 2, 5, or 9 points.
4. Click the Background Color list and select the color for the calibration background screen.
5. Click Configure... to adjust the area of the screen that will be used when performing calibrations. This may provide a more accurate calibration if you are planning to use a small area of the screen to show the stimulus.

Click Restore default to reset the respective calibration settings to the default value.

Manual calibration is an operator-paced calibration procedure with special graphics during the calibration procedure. The number of calibration points and their locations are by default, the same as for Regular calibration, but instead of a pulsating dot, two lines create an intersection that is used as the calibration point. When the space bar is pressed, the lines change color while calibration is performed and the lines move to the next calibration point. When the participant has looked at all points, the calibration results will be shown. If the calibration went well, click Accept and the Recording Start dialog box opens.

4.3.1.3 Infant Calibration

Infant calibration is used when conducting studies on infants. Small animations (in AVI format) are displayed where the dots normally appear. This works as an attention grabber suitable for small children. It can also be used when it is difficult for someone to follow the calibration instructions.

Tobii Studio can also display different AVIs to attract the test participant's attention if they begin to respond poorly or grow tired of the calibration AVI. These items are called attention animation AVIs. No calibration data is collected during the display of these AVIs.

To change the Infant calibration settings:

1. Type the calibration stimulus file path into the Calibration Animation field or Click the ... button to locate the file you want to use. Click the file and then click Open to select it as a calibration stimulus.
2. Type the file path into the Attention Animation field or click the ... button to locate the file you want to use. Click the file and then click Open to select it as an attention-grabbing stimulus.
3. Select the Show infant calibration instructions check box to view the calibration instructions before the calibration procedure begins. Clear the check box to hide the instructions.
4. Set Number of calibration points to 2, 5, or 9 points
5. Click the Background Color drop-down list and select the color for the calibration background screen

6. Click Configure... to adjust the area of the screen that will be used when performing calibrations. This may provide a more accurate calibration if you are planning to use a small area of the screen to show the stimulus.

Click Restore default to reset the respective calibration settings to the default value.

Some sample movies are included in the installation and can normally be found in the Infant Calibration AVIs folder (C:\ProgramData\Tobii\Studio\InfantCalibration)

Infant calibration is an interactive calibration mode where an operator uses the keyboard to control the calibration procedure.

To show the calibration animation selected in the Global Settings dialog box, press the RIGHT ARROW key during the calibration. When the participant is watching the animation, press the RIGHT ARROW key again to start collecting calibration data. It is assumed that the participant will focus on the center of the calibration animation. When enough data points are collected, the calibration will move on to the next calibration point. The operator can again press the RIGHT ARROW key to start collecting data. This is repeated until all calibration points have been displayed.

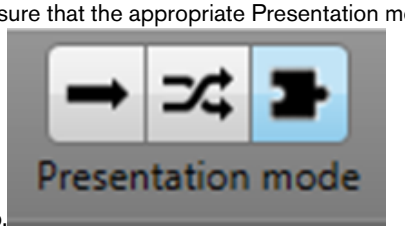
The following keys are used to control the Infant calibration procedure:

- RIGHT ARROW: Displays the calibration AVI at the next calibration point. If the calibration AVI is already visible, a calibration is made at that point before proceeding to the next.
- LEFT ARROW: Pause. Hides the calibration AVI or the full-screen attention-grabbing AVI
- UP ARROW: Displays the attention grabbing AVI

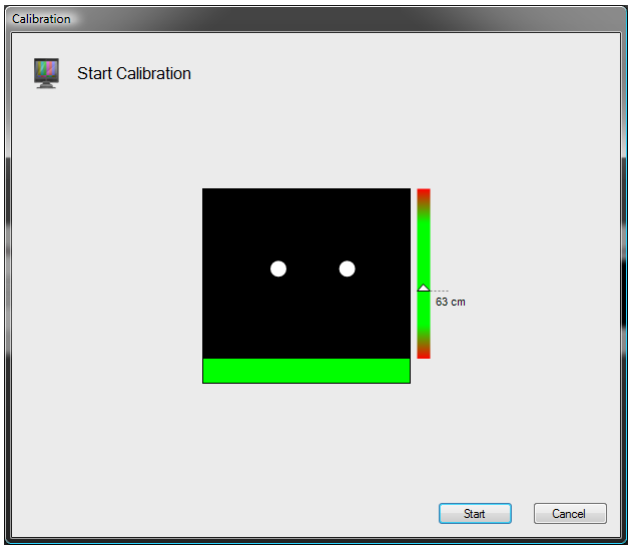
4.3.2 Making recordings

Place the participant in front of the eye tracker and make sure that he or she is sitting comfortably at the correct distance from the eye tracker. The distance depends on the hardware used; 64 cm is valid for the Tobii T Series Eye Trackers (read the T Series Eye Tracker user manuals for more information).

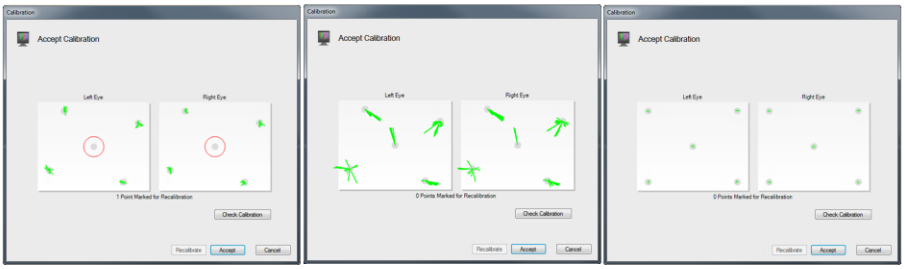
To start a Tobii Studio recording:

1. Ensure that the appropriate Presentation mode is selected in the Presentation mode selector in the Design and Record tab. 

2. Click the Start Recording button located at the bottom of the Design and Record tab. The Select Participant dialog box opens.
3. Create a new participant or use an existing participant.
   - To create a new participant, type the participant's name in the Name field. If you have created independent variables, select the correct values (if known before the test) for the participant.
   - To select an existing participant, click the Use Existing Participant tab and select a participant from the participants list by clicking the participant's row.
4. Click Continue to accept the selection and open the Calibration dialog box.
5. Use the track status box to help adjust the participant and the eye tracker position (e.g. chair position, table or the eye tracker stand). The eyes of the participants, displayed as two white dots in the track status box, should be in the center of the box and the distance indicator should display a value between 50 and 80 cm, depending on the eye tracker being used. The color of the bar at the bottom of the track status box should be green.



6. Instruct the participant to look at the calibration points as they move over the screen.
7. Click Start to initiate the calibration process. The first calibration point appears on the screen.
8. The calibration will stop automatically when all calibration points have been shown.
9. When the calibration is finished, the calibration results are displayed in two vector plots in the Calibration Result dialog box.



Problem: Calibration point missing
Solution: Select and recalibrate the missing point.

Problem: Large errors in calibration
Solution: Check eye-tracker, setup, glasses, and participant. Make new calibration.

Perfect calibration

The calibration plot shows error vectors - green lines (the length of each green line indicates the difference between the gaze point calculated by the eye tracker and the actual dot position). Recalibration of certain points should be made if the lines are long or if there are no lines at all at a certain point.

If the calibration was unsuccessful, the calibration result “Not Enough Calibration Data” will be displayed. If this is the case, re-position the test participant in front of the eye tracker and check for any factors that could be interfering with pupil detection (e. g. an infrared light source that is directed at the eye tracker sensor or the participant’s eyes, dirty or scratched glasses or droopy eyelids). Click Recalibrate to recalibrate the participant.

Optional: When you have completed the calibration on a screen, you can also assess the quality of your calibration by clicking the Check Calibration button in the Accept Calibration dialog box. The participants gaze point is displayed as a circle in real-time on the screen together with an image containing nine dots. Instruct the participant to look at the center of the dots. If the calibration was accurate, the gaze point should overlap the dots. The distribution of the dots also allows you to assess calibration accuracy in different areas of the screen. Click ESC to exit.

10. If the calibration is accurate enough for your study, click the Accept button to open the Start Recording dialog box.
11. In the Start Recording dialog box, enter a name for the recording (make sure to use informative names) and look at the track status box to confirm once more that the participant is correctly positioned in front of the eye tracker
12. Click Start Recording to show the test and record media and eye tracking data.
13. The recording concludes when all the media elements have been presented.
14. Once the recording has ended, you are ready to move to the Replay tab and analyze the recording.

To abort a recording press the Esc key at any time during the recording.

In cases of recordings ending prematurely (e.g. because of system hanging or software crashes), Tobii Studio has the support for repairing such recordings so that the data collected up to the point when the recording stopped can be used further for analysis. The next time Tobii Studio is started after the program has been shut down unexpectedly during a recording, you will see an Interrupted Recording dialog asking if the recording that was ongoing before the interruption should be repaired or deleted. If you select Repair, the software will attempt to repair the recording.

If the last element displayed when the recording ended was an image, a movie, an external video element, a scene camera element or a pdf, the video from that element will be lost and the gaze data will be replayed against a black background.

The timing between the user camera image, sound recording and gaze data can contain offsets so repaired recordings should not be used if the timing between these is of critical importance for the analysis.

4.4 Importing Tobii Glasses Data

After performing a recording using the Tobii Glasses, the gathered data can be imported into Tobii Studio for further analysis.

Before starting Tobii Studio for the data import (for more detailed information please read the Tobii Glasses User Manual):

1. Connect the Memory card reader to the computer. (If your computer has an integrated Memory card reader use that instead).
2. Turn the Recording Assistant off, remove the memory card and insert it in the memory card reader.
3. Close any AutoPlay dialog boxes that appear on the computer screen.

To import the Tobii Glasses data into Tobii Studio:

1. Start Tobii Studio. In the Tobii Studio Project Library dialog box create a new Project and Test. This will open Tobii Studio to the Design and Record view.
2. From Tobii Studio's menu bar, click File and select Import Glasses data
3. A dialog box opens, now select the Computer folder, and then double click on the Removable Disk icon labeled GLASSES (corresponds to the memory card) to open the memory card and view its contents. When opening the Import Dialog again, Tobii Studio will open the last selected folder.

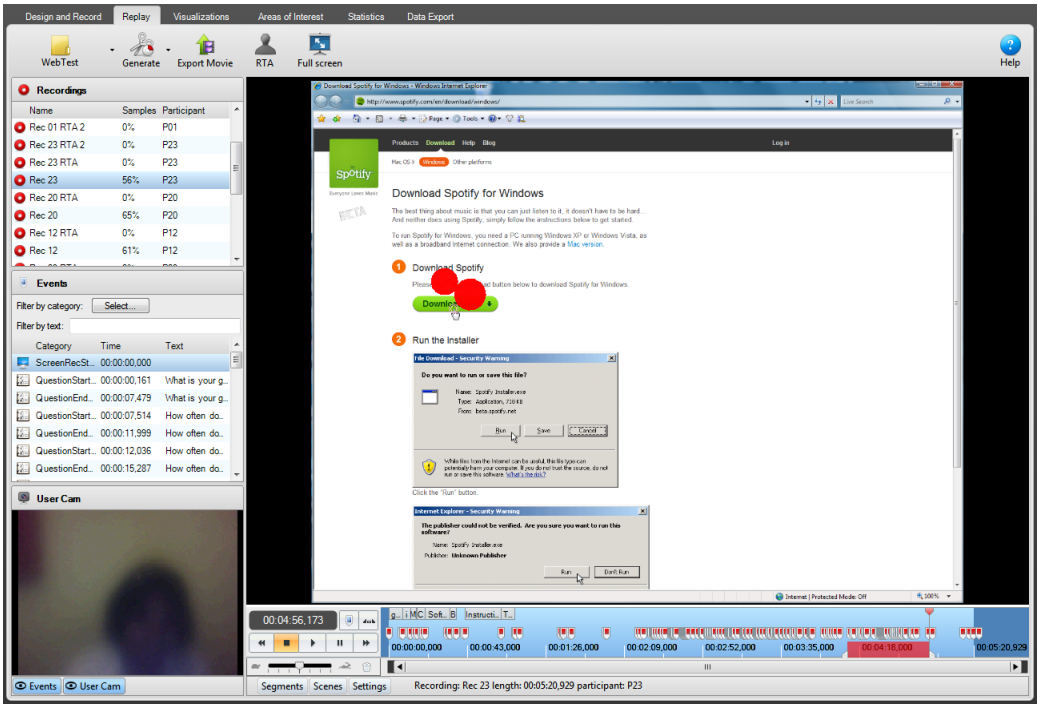
4. Double-click on the Project folder (Project_0) to open it. Then press the Open button to open the Tobii Glasses project (project.gpf). This opens the Import dialog box. Full path: Computer>GLASSES>Project 0>project.gpf
5. Select the Recordings and snapshot images you wish to import by checking or unchecking the respective check boxes, or by pressing the Check/Uncheck All button located below the list to select or deselect all the recordings.
6. Import Data Into: Select if you wish to import the recordings into an Existing test or a New test. Select the option Existing and use the drop down list to choose an existing test, or select New test and enter a test name in the text box.
7. To correct for parallax offset: Click the Settings button to set the Average Distance between the glasses and the target being viewed. This distance is used for calculating and mapping the gaze data accurately on the scene camera video. The selected setting will be applied to all selected Sessions on import.
8. The Participant Name Prefix feature allows you to add a prefix to the Participant Name during import of recordings from the Tobii Glasses. Sessions created on the Recording Assistant are normally converted into Recordings with a Participant Name that corresponds to the Session number on the Recording Assistant, e.g.: **Session #01** becomes Recording: **Rec 01**, Participant: **P001**. Each SD card used in the Recording Assistant will start the naming of Sessions in the same order: Session #1, #2, #3 etc. If multiple SD cards are used during a test there is a risk that the imported Sessions will be saved as multiple recordings with the same Participant Name in Tobii Studio. If different recordings have the same Participant Name, it will be impossible to filter the data based on participants or Independent Variables (such as age or gender) since there is no indication that these recordings are in fact different participants from different SD cards. To avoid this potential issue always insert a unique prefix in the Participant Name Prefix text entry field every time you import an additional SD card in a Tobii Studio Test. This feature will append the chosen prefix to the participant name, effectively creating a unique name and avoiding recordings being merged into existing participants. By default the name **Import 1** is given, change this name according to your own preference and import order or delete this preset name to remove any prefix and keep the original Tobii Studio Participant naming for Tobii Glasses recordings (P001, P002, P003 etc.).
9. When you are finished click the Import button to import the selected recordings and snapshot images. Tobii Studio will then import each Tobii Glasses Session as a Tobii Studio Recording.

Selecting the Video import check box in the Settings can repair corrupted video frames during import. Only select this option if the originally imported video shows corrupted video frames. Importing using this setting will take considerably longer time.

5 Replaying and Editing Recordings

After the recordings have been completed, you are ready to analyze the data. The Replay tab in Tobii Studio provides you with a way to dynamically view the eye tracking recording and user camera video, perform a basic qualitative analysis of a participant's behavior during the test, record participant interviews (Retrospective Think Aloud), code events, and edit recordings for further analysis. During replay, the gaze path video is overlaid on the stimuli, regardless of the media type.

The Replay tab also integrates tools to create media elements (scenes) from video stimuli and dynamic web content (e.g. Flash). These scenes can then be used to produce visualizations in the Visualization tab and eye tracking metrics descriptive statistics based on Areas of Interest on the Statistics tab.



The window while under the Replay tab is divided into three main areas:

- Replay header: Contains the Test selection button, Generate, Export Movie, RTA, Full Screen and Help buttons.
- Recordings pane: This is where you can select and delete recordings, view a list of the different events (Events), and read the user camera recording (User Cam).
- Replay pane: This is where you can view playback of the stimuli and recording of the participant's gaze, view the recording timeline, control the playback, create and edit segments, segment groups and scenes, and change viewing settings

From the Replay tab you can also launch the Velocity Chart. VelocityChart in Tobii Studio plots the angular eye velocity, gaze coordinates (raw or processed), and the classified fixation coordinates of a recording. The main purpose of VelocityChart is to help the user set the parameters in the data processing functions, particularly when using the I-VT fixation filter.

VelocityChart is a separate software application, but is launched from within Tobii Studio.

To launch the VelocityChart application:

1. Select the Replay tab in Tobii Studio.
2. In the Recordings pane, right-click on the recording you want to open in VelocityChart. Click Launch VelocityChart. The VelocityChart opens in a new window.

Read more on the Velocity Chart in *14.2 VelocityChart - Visualizing eye tracking data on a timeline.*

To play back a recording:

1. In the Recordings pane, click the recording you wish to view.

2. In the lower-left corner of the Replay pane, click the play button to start playback of the recording. Use the rewind, forward, stop, and pause buttons to control the playback.
3. While paused, click the RIGHT and LEFT ARROW keys on your keyboard to move forward or backwards, respectively, frame by frame.
4. Jump to different sections of the recording by dragging the marker on the Replay pane timeline, clicking the desired location, or clicking an event in the Events list in the Recordings pane.

5.1 Playback settings

The complete test session recording can be viewed at any time, with gaze data superimposed. The Replay tab is a flexible tool that allows you to customize different aspects of the recording playback and analysis detail.

5.1.1 Customizing the recordings list

In the Recordings pane, there is a list of all the recordings made in the selected test. By default, Tobii Studio displays – in the recordings list – the name of the recording, the quality of the recording as a percentage (samples), and the participant that was recorded. You can also display more information about the recording.

To make more information about the recording visible in the Recordings list of the Recordings pane:

1. Right-click anywhere on the recordings list.
2. Select Show in the context menu.
3. Now select, one at a time, the information you want to display in the list. The title of the new column will appear at the top of the list.

To sort the list by a recording detail:

1. Right-click anywhere on the recordings list.
2. Select Sort by in the context menu.
3. Choose the element to sort by.
4. Click the respective column headings to change the sorting order. (You can also click the heading you want to sort by and click again to reverse the sorting.)

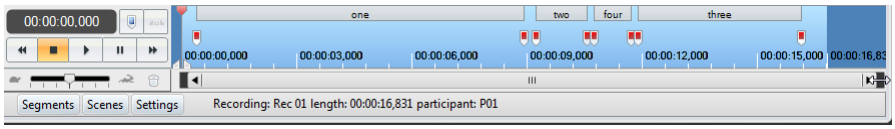
Types of information that can be shown in the recordings list:

- Name: ID of the recording (can be modified in the recordings list by clicking the ID)
- Date: The date and time when the recording was made
- Duration: The duration of the recording in seconds
- Color: The color used to identify the recording on the timeline in the visualizations under the Visualization tab (can be changed in the recordings list by clicking the color)
- Samples: The percent is calculated by dividing the number of eye tracking samples that were correctly identified, by the number of attempts. 100% means that both eyes were found throughout the recording. 50% means that one eye was found for the full recording or both eyes during half the time. Note that the eyes cannot be found when a person is looking away from the screen; this will result in a lower percentage. If the test is performed so that the participant is asked questions during the recording and occasionally looks at a test leader, an alternative method for determining the quality of the recording should be considered.
- Participant: The name of the test participant

5.1.2 Changing the timeline scale detail and playback speed

The timeline can be rescaled to show shorter time intervals. This can be useful when creating segments from a long recording or when it is important to be able to advance the replay slowly. It is also useful for separating events that happened close in time.

Zoom in and out on the timeline by moving the pointer to the edge of the scroll bar, which is located just below the replay timeline. When the pointer becomes a double-headed arrow (read the figure below), drag the bar towards the left for a more detailed timeline or towards the right for a better overview.



The playback speed can be changed to show the recording replay at a slower or faster pace. The playback speed bar is in the lower-left corner of the Replay pane. The speed is represented by the silhouettes of a hare and a tortoise for fast and slow.

Change the playback speed by dragging the marker on the speed bar towards the hare to increase the speed or towards the tortoise to decrease the speed. The middle line represents the original recording speed.

5.1.3 Customizing the view of the Replay tab

To provide a greater flexibility of analysis, the various panes and toolbars in the Replay view (Recordings, Events, User Cam, Segments, Scenes, and Settings) can all be resized or hidden/displayed. This allows you to customize the window so you have easy access to the functions you use most.

You can toggle between displaying and hiding the Events and User Cam panes by clicking their respective buttons at the bottom of the Recordings pane. The same goes for Segments, Scenes, and Settings, which have icons in the lower-left corner of the Replay pane. You can resize any of the panes by dragging its border in the desired direction.

The recording of a test session can be viewed in fullscreen mode. Fullscreen mode replay shows the recorded media in its original size, making it more easily viewable for qualitative analysis. The user cam and timeline are optional in the fullscreen mode.

To view the replay in fullscreen mode:

1. In the Replay pane, either:
   - Click the Full Screen icon in the header, or
   - Right-click the video and select Fullscreen in the context menu.

When in fullscreen mode, by right-clicking you get the following menu options, described below:

- Show Timeline: To be able to use all the functions of the timeline at the bottom of the fullscreen view (press T on your keyboard)
- Exit Fullscreen: To exit the fullscreen mode (or press ESC, or double-click)

5.1.3.1 Changing the replay video settings

In the lower-left of the Replay pane is the Settings button. Click the button to toggle between displaying and hiding some important replay Settings.

To modify the Overlay settings:

1. Untick the Draw Gaze Data and Draw Mouse Clicks check boxes to hide the gaze data and mouse clicks during playback of the recording.
2. Drag the Opacity marker between Transparent and Opaque to adjust the opacity of data representation.
3. Type or select the value for the gaze trail duration (in seconds) in the Trail Duration field.
4. Click the Overlay color box to open a color palette and select the desired color of the gaze overlay.

To select which sound is played during the playback of the replay:

1. Select Replay: On, to hear the test audio during playback.
2. Select User Camera: On, to hear the audio from the user camera (a microphone must be connected to the Tobii Studio computer and enabled during the recording).

The Snap to time markers option helps you when editing segments, as it snap to the white time markers on the timeline when you drag to change the segment start or end point. For details please read **How to edit segments** in *5.4.2 Generating segments manually* .

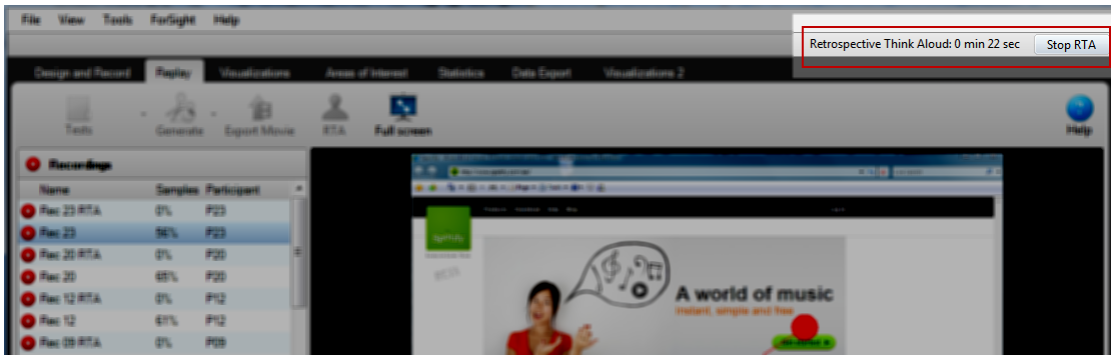
5.2 Performing a Retrospective Think Aloud recording

Retrospective Think Aloud (RTA) is a commonly used technique in which the test leader follows up an eye tracking test with an interview during which the participant explains his/her behavior during the test. Tobii Studio's RTA feature allows you to conduct

and record an RTA interview while showing a playback of the original Tobii Studio recording, or any other application to the participant, on the screen of the computer running Tobii Studio. Or it can also be used as an external sound recorder replacement during the interview. The RTA recordings will be available in the recordings list in the Replay view for playback and further analysis.

To make an RTA recording in Tobii Studio:

1. If there is no microphone already connected and configured, connect a microphone to the computer and then go to the Tools menu on Tobii Studio's menu bar and click Settings...
2. On the Screen and Video Capture tab, enable user sound recording by selecting the Record user sound check box and then selecting your audio source (click the Audio Source drop-down box and select the appropriate microphone).
3. Click OK to accept the changes or Cancel to close the window and disregard the changes.
4. On the Replay tab, select the recording in the Recordings list that you wish to show the participant during the RTA, or to associate with the RTA recording.
5. Click the RTA icon on the Replay header.
6. In the Start Retrospective Think Aloud Recording dialog box, enter a name for the recording in the Recording Name field. If you do not enter a name for the recording, Tobii Studio will name it automatically by using the name of the recording you have selected in step 4 and adding RTA as a suffix.
7. Click Start Recording to start the RTA session. Above the Replay header, a light gray tab indicates that the RTA recording mode is active. The duration of the recording is shown at the upper-right.



8. During RTA recording, you can use the playback controls to move through the original recording. Use other features in Tobii Studio, such as the Visualization tab, to display gaze plots and heat maps, and any Windows application (Tobii Studio must be minimized).
9. You can click the Full Screen button or right-click the recording screen and select Fullscreen to show the original recording in fullscreen mode. In this case, use the fullscreen controls to control the playback.
10. Click the Stop button on the right side of the gray RTA bar to stop the recording, or press the ESC or F10 key on the keyboard.

    Please note that, if you use the Esc key to exit full screen, this will also stop the recording.

11. The RTA recording will then be available in the recordings list in the Recordings pane. Use the playback controls to view the RTA recording.

RTA recordings can be edited and exported just like normal studio recordings. However, since no gaze data is collected during the RTA recording, you will not be able to use these recordings to create visualizations.

5.3 Managing and logging events

Events, such as the image element's display time and mouse clicks, are automatically registered in Tobii Studio's database and displayed in the Events list of the Recordings pane. These events are also displayed on the timeline as colored bookmarks. When you hold the pointer over the bookmark, the event details appear. If you click an event in the Events list, the timeline marker will jump to the position in the recording where the event occurred.

To enable/disable the types of events displayed in the list:

1. Right-click the list and selecting Filter by Category.... The Visible events and log categories dialog box opens.
2. Select the check boxes for the events you wish to display in the list.
3. Click OK.

In addition to these automatic events, you can also generate your own log events by using the coding scheme feature in Tobii Studio. These events, such as a participant clicking a link on a web page or looking at a specific part of a stimuli, will also be shown in the Events list.

During the playback of the recording, you can use these events to mark the sections in the recording that you find of interest or are more relevant to your study. You can then use the bookmarks on the timeline or Events list to find those sections quickly. For example, you can use the user camera to record the reactions of the participants to the stimulus presentation and use the coding scheme to log the parts in the recording where the participant was confused, distracted, or engaged. Later you can extract eye tracking metrics from these sections of the recording and compare the eye movement activity during the three behaviors.

You can also manually log events, which can be useful when creating segments. Segments can be used to create movies or scenes and the Events list can be filtered to only show specific events in the list and in the timeline.

With the Tobii TX300 Eye Tracker (Tobii TX300 Firmware 1.1 or later) it is possible to connect external devices to the sync port on the eye tracker such as a light sensor connected to the Cedrus StimTracker for Tobii TX300. The devices can then produce binary trigger events that will appear in data coming from the eye tracker as well as in Tobii Studio.

A binary signal can have one of two states, i.e. On or Off. The events appearing in the timeline and in the Event list indicate when the signal from the external device changes. When the signal changes from off to on, the event, *EventMarkerOn*, will appear on the timeline and in the Events list, and when the signal changes from on to off, the event*, EventMarkerOff*, will appear.

5.3.1 Logging events

In addition to the automatic logging of events, events can be logged manually on the Replay tab in Tobii Studio. However, before events can be manually logged, a coding scheme must be defined, i.e. you need to create a set of user-defined events and associate each event to a specific key on your keyboard.

To define a coding scheme:

1. Open the Design and Record tab.
2. Click the Setup button and select Coding Scheme...
3. Click a row in the Description column and type the name of the event.
4. On the Shortcut drop-down list, select the keyboard key you want to use to log the event.
5. Select Quick Logging if you want to prevent the log message dialog box from appearing when you click the key in the Replay tab.
   The New Log Message dialog box allows you to type a comment that will be associated to that specific event, or to select another event if you pressed the wrong key. The comment will be displayed in the Text column of the Events list.
6. Double-click the respective color to open a color palette and choose the color of the bookmark that is placed on the timeline.
7. Repeat steps 3-6 until you have created all your events. Then click OK.
8. Click the Replay tab, select the recording you would like to playback and start logging the events.

You can also use manually logged Events to create segments to help select portions of the recordings that can be used to create movies or scenes. In order to accomplish this, you need to create an event that bookmarks the start of the segment (e.g. Smiling Start) and another to bookmark the end of the segment (e.g. Smiling Stop). You can then go through your recordings and bookmark the periods where the participants smiled and use the automatic segmentation tool to create segments using those two bookmarks.

To edit a manually logged event:

1. Right-click the event in the Events list.
2. Select Edit Log entry...
3. In the Edit Log Message dialog box, you can select a new event type from the list or type information in the field.

4. Click OK to accept the changes.

To delete a manually logged event:

1. Right-click the event in the Events list.
2. Select Delete Log entry...
3. Click Yes to confirm the deletion.

5.3.2 Filtering events

The Events list can be filtered to show only specific events in the list and in the timeline. This feature allows you to locate and navigate quickly to different parts of the recordings. The filter will display events that contain the text you typed.

To filter events:

1. Select the recording you want to work with from the Recordings list.
2. In the filter field, located in the upper part of the Events list, type the first letters you want to start filtering by.
3. All other events in the Events list and bookmarks in the timeline that do not satisfy the filter criteria will be hidden.
4. Click the event you wanted to locate and the timeline marker will jump to the point on the recording when that specific event occurred.

To turn off the filter, delete the text in the filter field.

5.4 Creating video segments

A segment is a section of a Tobii Studio recording. The start and end point of the segment can be set manually using the time-line marker, or automatically using events. Segments are commonly used to create video exports of the gaze replay or to select data for analysis or export. Exported videos can then be viewed with external media players.

Segments can also be used to create scenes. In this case, the segment determines the section of the recording that contains the relevant gaze data to create visualizations or calculate eye tracking metrics.

5.4.1 Auto-generating segments

Before generating the segments, you first need to identify or create the events that you will use to determine the start and end points. Read the previous section to learn how to create events.

To automatically generate segments:

1. Click the Generate icon on the Replay tab and select Segments.
2. In the Auto Generate Segments dialog box, type a name in the Segment name prefix field, that will be used to identify the segment.
3. Select to Generate the segments for one of the:
   - Current recording.
   - All the recordings in the current test.
   - All the recordings in all tests.
4. Optionally, you can Add theSegment(s) to a Segment Group by selecting one of the existing Segment Groups from the dropdown list or select New Segment Group if you want to add the segments to a new group. A new Segment Group is going to be created and you will be prompted to enter a name for it after performing step 6.
5. Select the segment start and stop points from the event type lists.
   - You can also choose to add a time offset to the start or end of the segment. The offset can be used, for example, to adjust the size of the segment if you see that you are missing a small portion of the video in some of the recordings.
6. Click OK to create the segments
7. To view the segments, select the desired recording and make sure the Segments pane is visible.

If the start and stop events are the same type of event, for example a LeftMouseClick, the stop point event Next Left-MouseClick has to be selected. In this example, segments will be created between all left mouse clicks.

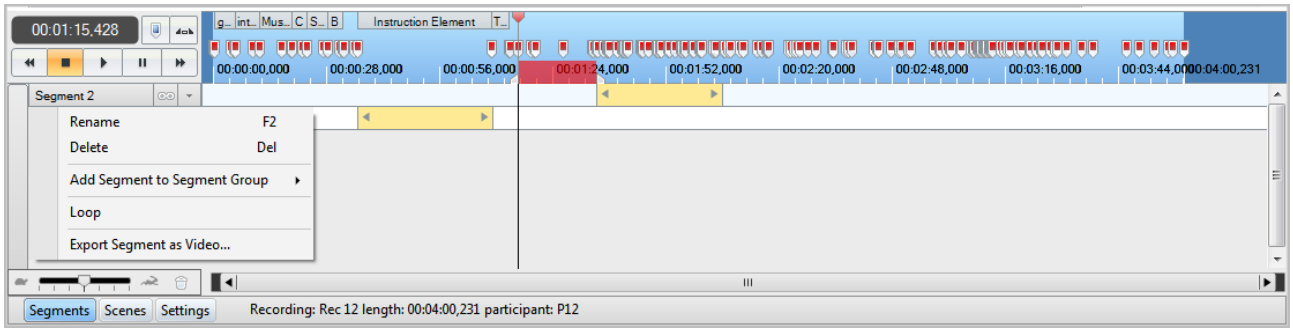
5.4.2 Generating segments manually

Go to the Replay view and choose the test you want to create segments for.

To create a segment manually:

1. Select the recording you wish to use to create the segment and make sure the Segments pane is visible.
2. Drag the timeline marker to the location on the timeline where you wish to set the start of the segment.

Drag the right handle of the timeline marker to the end position. The red color indicates the section on the timeline that is currently selected.



3. Right-click the selection and select Create Segment from Selection or Create Segment and Add to Segment Group (read *5.4.3 Grouping Segments*).
4. The new segment is displayed in the Segments pane. Repeat the steps to generate more new segments.

To edit an existing segment:

1. Click the Down Arrow located to the right of the segment name (the segment menu arrow).
2. Select Rename to change the segment's name or Delete to delete the segment from the recording
3. Select Add Segment to Segment Group if you want to add the segment to a group. For details read *5.4.3 Grouping Segments*
4. When hovering over the ends of the segment, once the pointer becomes a double-headed arrow, you can drag the segment to change the start and stop points. (In the Settings pane, select the Snap to time markers check box to make the segment edges snap to the timeline tick marks).

Segments can be used to repeatedly play back the same section of the recording. Click the infinity icon located just to the right of the segment name to loop one segment at a time.

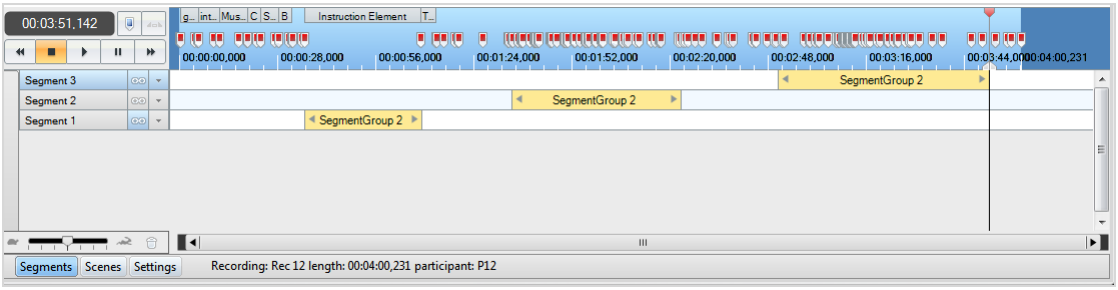
5.4.3 Grouping Segments

Segments can be grouped into Segment Groups. You can create multiple segments of different recordings and add those to a Segment Group and then you can further analyze the data of that Segment Group in the Statistics and Visualizations tabs and also use them when exporting the data in the data export view. This is useful when you want to cut out from your analysis certain portions of data of the recordings, and keep only the data Segments that are relevant for your study.

Recordings list can be filtered by Segment Groups in both Visualizations and Statistics tabs, in order to show and analyze only the data corresponding to that group of selected parts of recordings.

To add an existing segment to a Segment Group:

1. Click the segment menu arrow and select Add Segment to Segment Group.
2. Either choose one of the existing Segment Groups, or select New Segment Group.
3. If you choose to create a new Segment Group a dialog box displays where you have to set the Segment Group name. Enter the name and click OK.
4. The name of the Segment Group appears on the yellow line corresponding to each segment that was included in that group:



You can also add a segment to a Segment Group at the time of creating the segment by choosing Create Segment and Add to Segment Group (read *5.4.2 Generating segments manually*).

5.4.4 Exporting segments as videos

Segments can be exported into an AVI video format that can then be viewed using an external media player.

To export a single segment to a video:

1. Select the recording you wish to take the recording from.
2. Click the segment menu arrow and select Export to AVI.
3. In the Export to video clip settings dialog box, start by enabling/disabling the user camera and sound. The user camera video may be moved to another location in the exported video.
4. Select the user camera opacity and size.
5. Select the codec you want to use to produce the video and type or select the frame rate of the video export.
6. Click Save to export the video file.
7. In the Save As dialog box, type a file name and select the folder where you want to save it.
8. Click Save to complete the process.

To batch export segments to videos:

1. Click the Export Movie button on the Replay header.
2. In the Batch Export Segments to AVI Clips dialog box, start by choosing the folder where you want to export the videos to, type the folder path or click the ... button to browse to the folder location.
3. Select to export one of the following:
   - Export segments from:
     - Current recording
     - All recordings in current test
     - All recordings in all tests
   - Export recordings
     - Current recording
     - All recordings in current test
     - All recordings in all tests
4. Enable/disable the user camera and sound in the User camera settings section.
5. Select the user camera opacity, size and location. You can change its location by dragging it around.
6. Select the codec you want to use to produce the video and type or select the frame rate of the video export.
7. Click OK to initiate the batch export. A dialog box will appear when the export has completed. When you click OK, the folder containing the videos will be opened.

5.5 Creating scenes from dynamic content

Unlike segments which are mainly used for exporting the recording, scenes are primarily used to prepare the recording for the Visualization and Statistics tab. Recordings need to first be divided into scenes in order to produce visualizations and to extract AOI statistics from media elements that display dynamic content (i.e. movies, screen recordings, external video, scene camera, and web pages containing flash elements). A scene contains two elements: a static image set by the user that is used as the background for the visualizations, and the gaze data from the section of the recording where the image was extracted.

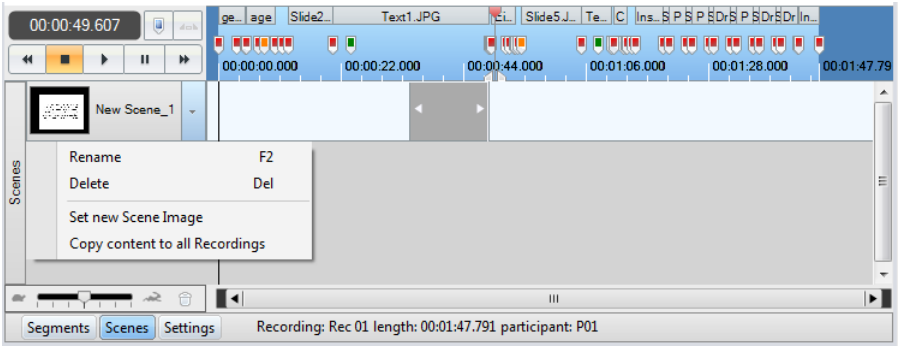
After being created, each scene will be available in the media list of the Visualization tab and in the media browser on the Statistics tab.

5.5.1 Creating scenes

Scenes can be created directly in the timeline, using the timeline marker to select the period of interest, or generated from existing segments. Creating scenes from segments is useful when using events to set the start and end points of the section of the recording covered by the scene.

To create a scene using the timeline marker:

1. Select the recording you want to use to create the scene and make sure the Scenes pane is visible.
2. Drag the timeline marker to the location in the timeline where you wish to set the start of the scene.
3. Drag the right handle of the timeline marker to set the end position. The red color indicates the section on the timeline that is currently selected. The starting and end point can be moved by dragging their respective markers.
4. Right-click the selection and click Create Scene from Selection.
5. The new scene is displayed in the Scenes pane together with the respective recording coverage information (indicated by a gray box).



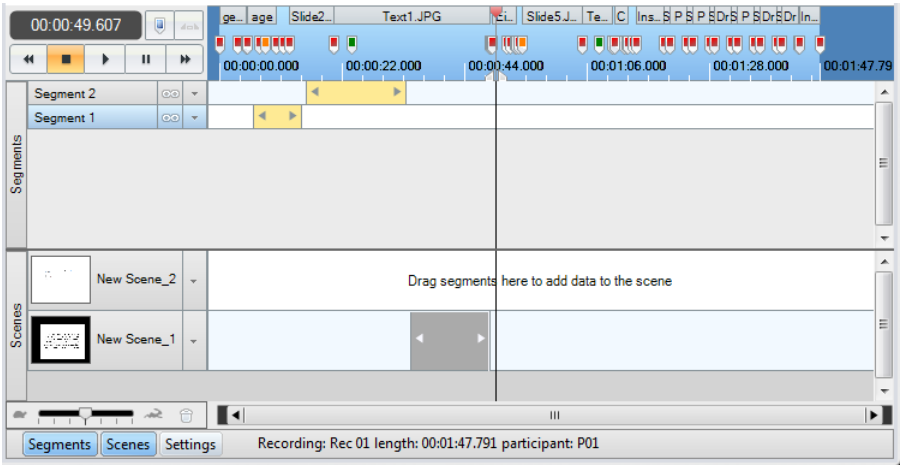
6. Open the Scene context menu by clicking the arrow next to the default scene name.
7. Select Rename to change the name of the scene.
8. Delete the default name and type the new one. This step is important for later identifying the scene in the media list of the Visualization tab and in the media browser on the Statistics tab.

When a scene is created, the scene will be copied to the remaining test recordings without the recording coverage information. If you wish to add the coverage information to that scene you need to either select the interval manually (select the interval in the timeline, then right-click the selection, select Add selection to scene, and then select the scene you want to use), or if you are creating scenes for a movie element, open the Scene context menu and select Copy content to all Recordings.

You can also create an empty Scene by right-clicking in the Scene pane and selecting Create new scene.

To create new scenes from segments:

1. Select the recording to use for this task and make sure the Segments and Scenes panes are visible.
2. Right-click the Scenes tab and select Create new scene.



3. Drag the segment to the desired scene. You can also drag it to an empty Scene pane which in turn will create a scene. In addition, you can drag multiple segments to the same scene.
4. The new scene is updated and displays the same recording coverage as the segment.
5. Open the Scene context menu and select Rename to change the name of the scene.

5.5.2 Generating scenes automatically

The automatically generated scenes are used mostly for E-Prime generated events. The events sent by E-Prime will be visible on the Events list as “SceneStarted” or “SceneEnded” event type, with the scene name on the Text field, and as bookmarks on the recording timeline.

To automatically generate the scenes:

1. Click on the Generate menu on the Replay tab and select Scenes.
2. Select the recordings on which you wish to generate scenes: single, import only the currently selected recording (the recording highlighted on the recordings list of the Replay view), or Batch if you wish to create scenes for more than one recording, on the Generate Scenes Dialog box.
3. In the Batch option you can deselect recordings by un-checking the checkboxes in front of each recording name.
4. Click on Generate to create the scenes. Each scene will take the middle frame, between the start and end “LogEvents”, as the background image.
5. If a recording already contains a scene with the same name as the one being created, a Tobii Studio Information dialog box prompts the user to either replace the existing scene element by the newly created one (press Yes), or to continue creating a new scene by adding an identifier to the name (press No), for example, if the old scene is called ‘fixation’ the new scene will be created as ‘fixation(2)’.
6. Press Yes or No to affect only the scene refered to on the Tobii Studio Information dialog. Press Yes to All or No to All to perform the same action to all scene conflicts.
7. Tobii Studio will then segment the video file into scenes that can be used to create AOIs, hot spots and gaze plots for your analysis.

5.5.3 Editing scenes

Several segments can be added to the same scene. This could be useful if the recording contains multiple instances of the same or an equivalent background.

To add more selections to the same scene:

1. Create a new segment selection (read the previous section for details).
2. Right-click the new selection.
3. Select Add Selection to Scene and select which scene you would like to add the selection to.
4. The scene is updated and displays the recording coverage derived from the selection.

When a scene is created, the background image is taken from the timeline marker's current location.

To change the background of the scene:

1. Drag the timeline marker to the section of the video recording that contains the images you wish to use and choose the frame that is most appropriate to overlay the gaze data on.
2. Click the Scene context menu arrow and then select Set new Scene Image.

To delete a scene:

1. Click the Scene context menu arrow.
2. Select Delete and then click Yes in the confirmation dialog box to confirm.

To delete a content section of a scene:

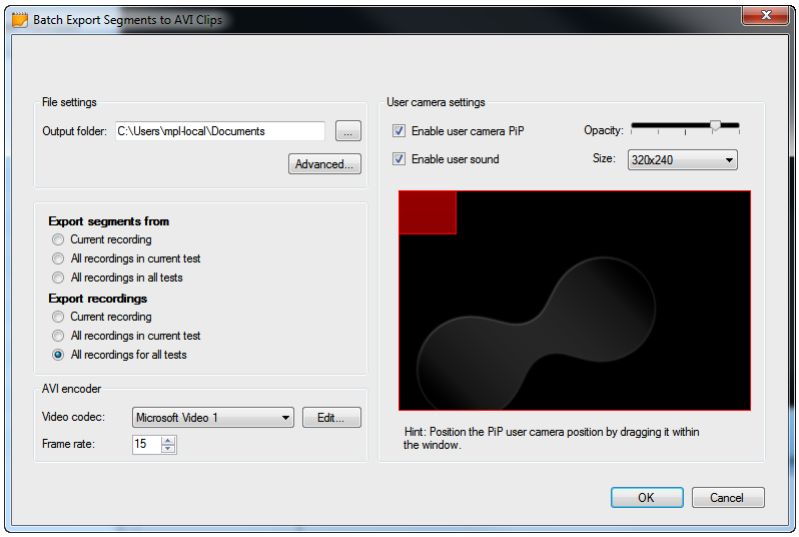
1. Right-click the content you want to delete from the scene.
2. Click Delete scene segment.

5.6 Exporting Recordings

Recordings are exported into an AVI video format that can then be viewed using an external media player. This export procedure is the same as exporting segments as videos (*5.4.4 Exporting segments as videos*).

To export the videos:

1. Click the Export Movie button on the Replay header.
2. In the Batch Export dialog box, start by choosing the folder where you want to export the videos to. Type the folder path or click the ... button to browse to the folder location.



3. Select to export one of the following:
   - Export segments from:
     - Current recording
     - All recordings in current test
     - All recordings in all tests
   - Export recordings
     - Current recording
     - All recordings in current test
     - All recordings in all tests
4. Enable/disable the user camera and sound from the video export.

5. Select the user camera opacity, size and location. You can change its location by dragging it around.
6. Select the codec you want to use to produce the video.
7. Type or select the frame rate of the video export.
8. Click OK to initiate the batch export of the video files.

5.7 Reviewing Glasses Data

The Glasses Data Viewer can be used to do the following:

- Make a frame by frame analysis of your recording and gaze position.
- View all Glasses data such as Gaze coordinates per frame including frame number.
- See any detected IR Markers overlaid on the video and individual IR Marker coordinates for a more in-depth qualitative analysis of the data.

The Glasses Data Viewer includes easy controls and short keys for replaying and pausing the recording, frame by frame steps, or for example skipping forward or backward in steps of 1, 5 or 60 seconds.

The Glasses Data Viewer also offers a text export of all IR Markers (including a marker used for calibration, without any IR Marker holder, indicated as #0) detected during the selected recording (per frame). With the possibility to export IR Marker data also comes the possibility to recognize events marked by IR Markers in a recording even when only a single IR Marker was in view, whereas the analysis of AOAs needs at least 4 IR Markers.

To open the Glasses Data Viewer for a specific recording:

1. Open your Project in Tobii Studio and go to the Replay tab.
2. From the list of Recordings, right-click on the recording you would like to view the data of.
3. Select Review Glasses data.

Close the Glasses Data Viewer, and repeat the steps above to view data from a different recording.

Read more about the Tobii Glasses data in the Tobii Glasses User Manual.

5.8 Parallax Correction Tool

The parallax correction tool is used in conjunction with Tobii Glasses. When a participant looks at objects from different distances during a test, some parallax will always occur when mapping this data to the scene camera video; since the Glasses are only calibrated at a single distance and the scene camera is never in the exact same position as the eye. Tobii Studio includes a Parallax Correction Tool. This tool allows you to set the relative distance between whatever the participant was looking at and the Glasses and will calculate the correct gaze position on the scene video based on these settings. When importing, the Default distance setting is always the calibrated distance of 1 meter.

To see the current distance settings and parallax corrections:

1. After importing the appropriate Project and Recordings into Tobii Studio, open the Replay tab in Tobii Studio.
2. From the Recordings list on the left hand side, select the Recording you wish to work with.
3. At the bottom of the window, click the Glasses Tools button. The Glasses Tools panel will expand between the timeline and the horizontal scroll bar.

In the Glasses Tools panel the Default Distance is stated, which corresponds with the the white area in the adjacent timeline representation. Individually corrected sections are indicated in gray with the appropriate distance noted.

To open the Parallax Correction Tool:

1. Follow steps 1-3 above to open the Glasses Tools.
2. Click the Ruler button below the playback controls, to the right of the stated current Default Distance. The fullscreen Parallax Correction Tool will now open.

To change the Default Distance for the selected recording:

1. With the fullscreen Parallax Correction Tool open, click the down arrow button to the right of the stated current Default Distance.

2. Select a predetermined range or Set custom distance... . If setting a custom distance, type the desired distance in centimeters and click OK. The Default Distance header turns green and states the new distance.
3. Click Save changes in the top right section of the tool when finished making alterations. This will take you back to the Replay screen.

Changes made to both the Default Distance and individually selected sections are highlighted in green before they have been saved. Click Save changes while in the fullscreen Parallax Correction Tool to update the gaze data overlay. Only after the save and update has taken place will the replay show the data corrected for the set distances.

Select Close in the fullscreen Parallax Correction Tool to exit the full screen mode without saving any changes made. If you try to close without saving changes, you will be asked if you want to save your changes before closing.

To specify a new section with a new distance:

1. Open the fullscreen Parallax Correction Tool.
2. In the timeline, select the time you want to set a distance for. Do so by dragging the timeline marker to the start of the desired interval and then dragging the right handle to the end of the interval. For setting a more precise interval, right-click the estimated selection, click Set Time for Selection..., enter the exact start and end times, and click OK.
3. Right-click the selection and move the over Create Parallax Correction from Selection...
4. Select a predetermined range or Set custom distance... . If setting a custom distance, type the desired distance in centimeters and click OK. The selected interval is added to the Distance timeline in green.
5. Click Save changes in the top right section of the tool when finished making alterations. This will take you back to the Replay screen.
6. Click the Glasses Tools button at the bottom and notice the gray interval with the distance you selected

Multiple corrections can be made before clicking the Save changes button.

If creating a new parallax correction that covers any part of another correction, you will be prompted whether you want to continue with overwriting the previous distance.

To change or remove a specific section of the recording:

1. With the fullscreen Parallax Correction Tool open,
2. Right-click the section you want to make a change to.
3. Select which change you would like to make (Set time, Set Distance, Clear, Clear all). Sections where changes are made turn green and state the new distance, and cleared sections return to the Default Distance.
4. Follow the onscreen prompts.

6 Defining fixations

During a recording, Tobii Eye Trackers collect raw eye movement data points every 3.3 to 33 ms (depending on the sampling data rate of the eyetracker). Each data point will be identified with a timestamp and "X,Y" coordinates, and sent to Tobii Studio. In order to visualize the data, these coordinates will then be processed further into fixations and overlaid on a video recording of the stimuli used in the test or on a static image, or used to calculate eye tracking metrics (read the Tobii whitepaper entitled *Tobii Eye Tracking. An introduction to eye tracking and Tobii Eye Trackers* to learn more about eye movements and fixations). This process is conducted by applying an eye movement classification or a fixation filter to the data.

Fixation filters are responsible for how fixation data, such as fixation count, duration, and location, is calculated. This data in turn affects how gaze plots, heat maps, clusters, and eye tracking metrics are inferred. Fixation identification is mostly a mathematical and statistical process that attempts to describe how the eye moves. Despite the accuracy and flexibility of some of the algorithms, the limiting factor is that there is no precise definition for the start and end of a fixation and thus the identification process still remains partly subjective. Therefore, the best identification validation process is still to perform a test where you compare the fixation filter data with an observer's subjective impression on the position and duration of the fixations. If you do not have any particular requirements in your study, regarding how fixations should be defined, use Tobii Studio's default fixation filters setting.

For additional information about the fixation filters, please read the following Tobii whitepapers, that can be found on Tobii website, under the Library section:

- Timing Guide for Tobii Eye Trackers and Eye Tracking Software
- Tobii Studio Timing Testing

To choose or modify the fixation filter settings:

1. Choose from the main menu Tools > Settings..., or, from the Design and Record tab, click Setup and select Settings... to open the Global Settings dialog box.
2. Select the Fixation Filters tab.
3. Select the type of filter you want to use. Choose between:
   - I-VT filter
   - Tobii fixation filter
   - ClearView Fixation filter
   - Raw Data - If you select Raw Data, Tobii Studio will display all the eye position samples recorded by the eye tracker without aggregating it into fixations.
4. Specify whether you want the Eye Selection Filter to use the average gaze point calculated from the gaze data samples from both eyes, use the left eye's gaze data only, or use the right eye's gaze data only
   - If either the Left or the Right option is selected, only the data that is collected from the left or the right eye is used for the fixation classification. The data from one eye will only be used if the eye tracker is certain that the data collected in a sample is from the selected eye (see table below). However, there is one exception; if only one eye was detected during calibration, all samples collected during a recording will be assumed to be associated to the eye detected during the calibration. If, during the calibration, only one eye was detected and two eyes are detected during the recording, only the data from the eye specified by this parameter will be used.
   - The Average setting makes an average of the position data from the left and the right eye. If only one eye is detected, it uses the data from that eye even if it is not completely sure which eye has been detected. However, if only one eye is detected and the eye tracker cannot at all determine which eye it is, the data is discarded unless only one eye was detected during calibration. If only one eye was detected during calibration and two eyes are detected during recording, large offset errors can occur since the eye model created for the eye detected during the calibration will be applied also on the eye not present during calibration. In the general case, the left and right eyes are not identical.
   - Unlike the *Average* setting, the *Strict average* setting discards all samples where only one eye has been detected. Only when both eyes are detected simultaneously, an average position of the two eyes will be calculated and outputted. If only one eye was detected during calibration, but two during the recording, this will lead to the same issues as described for the *Average* setting.

Validity Codes Eye Selection Option						
	L	R	Left	Average	Strict Average	Right
Found both eyes	0	0	Data: Left eye	Mean**	Mean**	Data: Right eye
One eye certain left	0	4	Data: Left eye	Data: Left eye		
One eye probably left	1	3	Data: Left eye	Data: Left eye		- *
One eye uncertain which one	2	2	- *	- *		- *
One eye probably right	3	1	- *	Data: Right eye		Data: Right eye
One eye certain right	0	4		Data: Right eye		Data: Right eye
No eyes	4	4				
* Data from the one eye found will be used if calibration was made using only one. ** Arithmetic mean						

Validity codes are codes that the eye tracker uses to describe how certain it is that it found a specific eye. The lower the value, the more certain the eye tracker is. These values can be found for each eye tracking data sample in text exports of eye tracking data.

Never perform a calibration with only one eye if the participant will use both eyes during the study. Large offset errors may be introduced in the data.

Tobii Glasses note:

As a result of Tobii Glasses only recording one eye, “left” or “Strict average” will not provide data for visualizations and statistics.

5. Depending on the fixation filter that you choose at step 3, perform the filter specific settings, according to the detailed description in the following sections for each type of filter:
   - I-VT Fixation Filter
   - ClearView Fixation Filter
   - Tobii Fixation Filter
   - Raw Data Filter
6. To save the filter configuration, click the *Save filter config* button, enter a file name and location and then click *Save*.
7. Click *Apply* to apply the changes and/or OK to accept the changes and close the Global Settings dialog box.

Saved filter settings can be used at a later point in time by clicking the Load filter config and then loading a previously saved filter configuration file.

- As previously mentioned, the fixation filter affects how gaze plots, heat maps, clusters, and eye tracking metrics are calculated. Choosing a fixation filter does not modify the raw gaze data recorded by Tobii Studio and you can therefore change the filter settings without affecting the original data recorded.
- You can use the Velocity Chart to tune the IVT Fixation Filter and the Raw Data Filter. For details please read *14.2 VelocityChart - Visualizing eye tracking data on a timeline*

6.1 I-VT Fixation Filter

The general idea behind an I-VT filter is to classify eye movements based on the velocity of the directional shifts of the eye. The velocity is most commonly given in visual degrees per second (°/s). If the velocity of the eye movement is below a certain threshold the samples are classified as part of a fixation.

The Tobii I-VT filter is developed to work for stationary eye trackers. In most cases the Tobii I-VT fixation filter will correctly classify fixations in recordings made with previous versions of Tobii Studio. However, since the new I-VT fixation filter requires

accurate 3D positioning of the eyes, it may fail to correctly classify eye tracking data from recordings made with previous versions of Tobii Studio where Tobii X series eye trackers (stand alone eye tracker without a built-in screen) have been used.

The I-VT fixation filter will fail to correctly classify eye tracking data recorded with Tobii Glasses even though the I-VT fixation filter may be enabled by default during analysis of snapshots. Tobii Glasses users should manually switch from I-VT fixation filter to Raw data filter. For information concerning limitations of the Raw data filter applied on Tobii Glasses recordings, please refer to the Tobii Glasses User manual.

The default values of the I-VT fixation filter parameters have been set to provide accurate fixation classifications for the most common eye tracking use cases, e.g. web, market research and standard reading studies. However, depending on the type of eye tracking study conducted, the settings in the I-VT filter can be adjusted to better suit the particular study, to get finer grained fixation data or to compensate for high levels of noise.

It is strongly recommended that you use the VelocityChart application to examine the effects of the filter settings when setting the parameters in the I-VT fixation filter. The data processing functions within the I-VT fixation filter are described in the sections below.

For additional information about the fixation filters, please read the following Tobii whitepapers, that can be found on Tobii website, under the Library section:

- Tobii I-VT Fixation Filter — Algorithm Description
- Determining the Tobii I-VT Fixation Filter's Default Values

6.1.1 Gap fill-in (interpolation) – Default for I-VT

The purpose of the Gap fill-in function is to fill in data where valid data is missing. For example, this is to prevent a fixation in which a few samples are missing as being interpreted as two separate fixations. Such loss of valid data can occur due to temporary reflections in the participant's eyes or glasses, etc. In these cases the data loss is usually limited to a short period of time, typically less than 50 ms. Data can also be lost due to legitimate reasons such as the participant blinking or looking away. These kinds of data losses usually result in data gaps longer than 100 ms. Losing data in these latter cases may be perfectly fine for applications of eye tracking where attention is measured since participants do not see anything while blinking or looking away anyway.

The Tobii Studio user can control the limit of how large the gaps of data are that should be filled-in by setting the parameter "Max gap length". The default value of "Max gap length" is 75 ms, which is between the two data loss scenarios just mentioned above. According to Komogortsev et. al 2010, minimum blink duration is 75 ms.

Data is filled-in in the data gap through linear interpolation. Data points are added along a straight line between neighboring valid data points. Interpolation is done for each eye separately.

Komogortsev et. Al. 2010. Standardization of Automated Analyses of Oculomotor Fixation and Saccadic Behaviors. IEEE Transactions on Biomedical Engineering, vol. 57 (11), pp. 2635-2645.

6.1.2 Noise reduction

6.1.2.1 MovingAverage – Not default for I-VT

All measurement systems, including eye trackers, experience noise. Noise can come from imperfections in the system setup as well as from influences and interferences from the environment in which the measurement takes place. In eye tracking research where the fixation is the eye movement of interest, other minor eye movements such as tremor, and microsaccades (*Yarbus 1967*) can also be seen as noise. In the most basic form, I-VT filters calculate the velocity by multiplying the change in position between two consecutive sample points with the sampling frequency. If the sampling frequency is low, the eye will have time to do quite large shifts of direction between two samples which makes it easy for the eye tracker to distinguish between real eye movements and noise. The higher the sampling frequency is, the smaller the eye movement will be between two consecutive samples at a given eye velocity. Noise will therefore have a greater impact in a high frequency system even though it has the same magnitude as in a low frequency system.

The *Noise reduction (moving average)* function is a symmetric moving average filter. It produces output data by creating an arithmetic mean of a number of data points from the input data. The number of input data points used to produce each output point is controlled by the *Window size* parameter. Each produced output data point is given the timestamp of the input data point that was in the center of the window: the input median point (the window size parameter must be an odd number). The window size is dynamically adjusted so that the window never stretches outside the valid data series.

The default value of the Window size parameter is 3 samples, which is the lowest possible value having an effect on the data. Always use the VelocityChart application to examine the noise reduction effects while applying and adjusting the parameters in the Noise reduction function.

Yarbus L. 1967. Eye Movements and Vision. Translated from the Russian edition (Moscow, 1965) by Basil Haigh. Lorrin A. Riggs, Translation Ed. Plenum, New York, 1967. xiv + 222 pp.

6.1.2.2 MovingMedian — default for I-VT

The Moving Median noise reduction function is accessible using the I-VT fixation filter and the Raw data filter.

Statistically, the moving average function is optimal for recovering eye movement data in the eye tracking data series if the fluctuations are normally distributed, such as noise around a fixation. However, a normal distribution does not place high probability on large deviations, which occur once a saccade take place. This explains why the edge between a fixation and a saccade will be disproportionally smoothed in the output data. If the fluctuations are instead assumed to be Laplace distributed, the moving median is statistically optimal. For a given variance, the Laplace distribution places higher probability on rare events such as saccades than does the normal distribution. This explains why the moving median noise reduction function tolerates saccades better than the moving average noise reduction function and why the median noise reduction filter better preserves the amplitude of the saccade velocity.

The median noise reduction function is a symmetric moving median filter. It produces output data by calculating the median value of a number of consecutive data points from the input data series. The number of input data points used to produce each output data point is controlled by the *Window size* parameter. Each produced output data point is given the timestamp of the input data point that was in the center of the window: the median point of the input window (the window size parameter must be an odd number). In cases where the window is not entirely filled with input data points no output data will be produced. The window may be short of data points due to the fact that the window stretches outside a data series with valid gaze, or small fractions of data points are missing within the window. Typically, the window stretches outside a valid data series at the beginning and end of a blink, or at the beginning and end of a recording. Loss of small fractions of data can occur as a result of temporary reflections, occlusions, etc., and can partly be solved by using the *Gap fill in* function *6.1.1 Gap fill-in (interpolation) – Default for I-VT*.

6.1.3 Velocity calculator – Mandatory for I-VT

The *Velocity calculator* function assigns an angular velocity (visual degrees/second) to each gaze data point. Angular velocity refers to the angular velocity of the eyes relative to the stimuli rather than relative to the eyeballs. The velocity calculator is mandatory in the I-VT fixation filter since the I-VT fixation classifier operates on angular velocity.

The *Velocity calculator* function estimates the eyes' angular velocity for each data point by dividing the angular difference between a preceding and a subsequent data point with the time interval between them. The time interval is set by the parameter *window length* in the *Velocity calculator* function. The Velocity Calculator will only produce velocity output data if the entire window contains input data. This means that gaps in the input data (like the ones caused by blinks) will result in larger gaps in the output data. The size of the output gap will be equal to the input gap plus the number of data points included by the window length parameter.

The default value of the parameter *window length* is 20 ms. The default value is based on Tobii internal test results, which are explained in the whitepaper "Determining the Tobii I-VT Fixation Filter's Default Values" available on the Tobii website.

The velocity data is only accessible for the user through VelocityChart text export.

6.1.4 I-VT fixation classifier – Mandatory for I-VT

The I-VT fixation classifier is based on the I-VT (Velocity-Threshold identification fixation filter) as described by Salvucci and Goldberg (2000) and Komogortsev et. Al (2010). It is a threshold function that operates on eye tracking data where each data point has an assigned angular velocity. In Tobii Studio angular velocity is assigned to eye tracking data in the *Velocity calculator* data processing function as described in the previous section.

The I-VT fixation classifier applies an angular velocity threshold on each data point. The threshold value is given in degrees/second and is adjusted by setting the parameter Velocity threshold in the Fixation filter dialog box. Data points with angular velocity below the threshold value are classified "fixation" and data points above are classified "saccade". The default *Velocity threshold* value 30 degrees/ second. The default value was chosen based on Tobii internal testing as well as reviewing eye tracking litterature, e.g. Rayner, K. et. al. (2007), Over et al. (2007) and Komogortsev et. Al (2010), to identify commonly used settings.

According to the *I-VT fixation classifier,* a fixation is an unbroken chain of data points all classified "fixation"- data points. The fixation coordinate is calculated as the arithmetic mean value of the coordinates of the data points beloning to the specific fixation.

Komogortsev et. Al. 2010. Standardization of Automated Analyses of Oculomotor Fixation and Saccadic Behaviors. IEEE Transactions on Biomedical Engineering, vol. 57 (11), pp. 2635-2645.

Rayner K., Li X., Williams C.C., Cave K.R., Well A.D. 2007. Eye movements during information processing tasks: Individual differences and cultural effects. Vision Research, vol. 47 (21), pp. 2714-2726.

Over E.A.B., Hooge I.T.C., Vlaskamp B.N.S. and Erkelens C.J. 2007. Coarse-to-fine eye movement strategy in visual search. Vision Research, vol. 47 (17), pp. 2272-2280.

6.1.5 Merge adjacent fixations – Default for I-VT

The purpose of the *Merge adjacent fixations* function is to merge fixations that have been incorrectly split into multiple fixations. Noise and other disturbances can cause the I-VT classifier to incorrectly classify data points that should belong to a fixation as not being part of it. This will split the fixation into multiple fixations, which are all located close together. The *Merge adjacent fixations* function can be set to merge these multiple fixations into one fixation.

The *Merge adjacent fixations* function has two threshold parameters:

- *Max time between fixations* defines the maximum time interval between separate fixations that should be merged. The default value of *Max time between fixations* is 75 ms, which is less time than participants will need to perform a fixation elsewere and then revisit the area of the previous fixation. Salojärvi et. Al. (2005).
- *Max angle between fixations* defines the maximum visual angle of the eyes between separate fixations that should be merged. The default value of *Max angle between fixations* is 0,5 degrees, which is to compensate for normal noise levels while not losing too much fine grained fixation data. Additionally the 0,5 degrees value allows to filter out micro saccades (Komogortsev et.al 2010) which usaually have amplitude of 0,5 degrees or less (Yarbus 1967).

Salojärvi J., Puolamäki K., Simola J., Kovanen L., Kojo I., and Kaski S. 2005. Inferring relevance from eye movements: Feature extraction. Technical Report. Publications in Computer and Information Science, Espoo, Finland. PASCAL EU Network of Excellence challenge.

Komogortsev et. Al. 2010. Standardization of Automated Analyses of Oculomotor Fixation and Saccadic Behaviors. IEEE Transactions on Biomedical Engineering, vol. 57 (11), pp. 2635-2645.

Yarbus L. 1967. Eye Movements and Vision. Translated from the Russian edition (Moscow, 1965) by Basil Haigh. Lorrin A. Riggs, Translation Ed. Plenum, New York, 1967. xiv + 222 pp.

6.1.6 Discard short fixations – Default for I-VT

The purpose of the *Discard short fixation* function is to remove incorrectly classified fixations that have too short a duration to be real fixations. As the brain needs to take in visual input for a while before it has enough data to process it, a fixation (which is when this visual input is collected) cannot be infinitely short. The *Discard short fixation* function can be set to remove these incorrectly classified fixations. The *Discard short fixations* function can also be used to decrease the temporal resolution of fixation data.

The parameter *Minimum fixation duration* sets the threshold of how short a duration a fixation can have to be classified as a "fixation". All data points belonging to fixations shorter than the threshold value will be reclassified as non-fixation data points. The default value of *Minimum fixation duration* is 60 ms, which is below the lower limit of fixation duration according to Salojärvi et. al. (2005) and Komogortsev et. al. (2010). The default value 60 ms is set conservatively to also allow for complex occulomotor behaviour such as express saccades. For most attention studies a minimum fixation duration of 100 ms is appropriate.

Salojärvi J., Puolamäki K., Simola J., Kovanen L., Kojo I., and Kaski S. 2005. Inferring relevance from eye movements: Feature extraction. Technical Report. Publications in Computer and Information Science, Espoo, Finland. PASCAL EU Network of Excellence challenge.

Komogortsev et. Al. 2010. Standardization of Automated Analyses of Oculomotor Fixation and Saccadic Behaviors. IEEE Transactions on Biomedical Engineering, vol. 57 (11), pp. 2635-2645.

6.2 Tobii Fixation Filter

The Tobii Fixation Filter is an implementation of a classification algorithm proposed by Olsson (2007) and is currently used as the default fixation algorithm in Tobii Studio. The algorithm behaves mainly like an I-VT filter that detects quick changes in the gaze point using a sliding window averaging method.

Assuming that the eyes move between two different fixations, the following distinctions are made:

- If a segment of the signal is of constant or slowly changing mean value due to drift, we classify it as one fixation.
- If there is an abrupt change in the signal, the eyes have moved to another fixation location.

By designing an algorithm that produces a notification whenever it detects a change in the mean, we are able to group the data into separate fixations. When this is done, we can estimate the spatial position of each individual fixation based on the information contained within its timeframe.

Before the fixation algorithm is applied to the data, the system goes through the recording data and identifies sections with missing data. The filter then interpolates the missing data for sections that have a duration below 100 ms (6-7 data points at 60Hz) and breaks the recording data set into subsets when the sections are larger than 100ms. The following steps are then applied to each data subset independently.

First, a feature, [**dif**], is calculated as the vector difference between two data point windows located before and after the current gaze data point. Each window has a fixed number of [**r**] gaze data points and the difference is calculated using the average X and Y coordinates of these points. Once **dif** has been calculated for all the data points in the recording, we then identify peak values, i.e. the d values that are greater than both of its two closest neighbors. Next, we go through the list of peaks once more and remove all the peaks that are smaller than the highest peak within a window of radius **r**. The peaks are then added to a list under the condition that they are at least as great as a user-defined threshold - [**h**] **Velocity Threshold**.

The fact that the threshold is determined relative to the window size **r**, makes the algorithm behave like an I-VT filter. In fact, the window size is fixed to 5 data points, so this has the same effect as if **dif** had been divided by 5 and the threshold had been **h** x 5 (for example, if the **Velocity Threshold** is set to 35 pixels, it will be equivalent to setting a threshold to (35/(16.6×5)=0.42 pixels/ms, on a 60 Hz eye tracker).

The list of peaks is then processed into fixations, where the start and end points of a fixation are set by two consecutive peaks. The spatial positions of the fixations are calculated by taking the median of the unfiltered data points in that interval. After the location of each fixation has been determined, the fixation data goes through a final iteration. First the Euclidean distances between all the fixations are calculated and if the distance between two consecutive fixations falls below a second user defined threshold [**d**] – **Distance Threshold**, the two fixations are merged into a single fixation. The process is repeated until no fixation point is closer to each other than the threshold. The fixation identification process is then complete.

The timestamp of the fixation is taken from the first sample included in the fixation and the duration is measured from the elapsed time between the first and last sample included in the fixation.

The Tobii Fixation Filter is both affected by the sample rate of the eye tracker and the image resolution, since **h** is calculated in pixels. For example, a 35 pixel setting will correspond to 35/(16.6×5)=0.42 pixels/ms threshold on a 60 Hz eye tracker, while on a 300 Hz eye tracker the threshold will be 35/(3.3×5)=2.12 pixels/ms.

Due to the initial missing data interpolation, if there is no significant change in the position of the gaze data points before and after 100 ms of the missing gaze data, the fixation will remain intact, i.e. one single fixation. However, if the consecutive missing gaze points together account for more than 100 ms (6-7 data points at 60 Hz) of missing data, the fixation is split into two separate fixations, irrespective of its location.

For more details and pseudo-code, read the Appendix of Olsson (2007) Master Thesis.

P. Olsson. 2007. Real-time and offline filters for eye tracking. Msc thesis, KTH Royal Institute of Technology, April 2007.

6.3 ClearView Fixation Filter

The ClearView fixation algorithm is based on the I-VT (Velocity-Threshold Identification fixation filter) outlined by Salvucci and Goldberg (2000). The velocity feature is calculated by measuring the distance between two adjacent data points. Each point is then labeled as a fixation if the velocity is below a certain threshold. Otherwise it is labelled as a saccade. The threshold is set by selecting a **Velocity Threshold** value, i.e. this value represents the maximum pixel-distance between two consecutive data points for them to be considered part of a fixation. Every point with a calculated velocity located above the threshold is treated as a saccade point and discarded. This fixation filter also allows you to set a minimum fixation duration i.e. fixations with a

duration below the **Duration Threshold** value will be discarded from the analysis. This feature can be used, for example, to discard "involuntary fixations" from your data set based on a duration threshold.

The location of the fixation point is determined by using the mean of the X and Y coordinates of the raw gaze data points belonging to the same fixation. The timestamp of the fixation is taken from the first sample included in the fixation and the duration is measured from the elapsed time between the first and last sample included in the fixation.

The basic idea behind these algorithms is that if we know the eye tracker sample rate and measure the distance between neighboring gaze data points, we can calculate changes in the eye movement velocity for all eye movement samples. During this process the raw data points are assigned to the same fixation if the velocity remains below a certain threshold or to a new fixation when it rises above this threshold. The location of the fixation is then determined by finding the median or mean of the X and Y coordinates from the raw data points belonging to the same fixation.

The I-VT ClearView uses a velocity threshold unit that is based in pixels instead of deg/s. Consequently, if you wish to change the **Velocity Threshold** setting you need to consider the sample rate of the eye tracker as well as the image resolution when calculating the speed. For example, a 35 pixel radius will correspond to 35/16.6=2.11 pixels/ms threshold on a 60 Hz eye tracker, while on a 300 Hz eye tracker the threshold will be 35/3.3=10.6 pixels/ms.

D.D. Salvucci and J.H. Goldberg. 2000. Identifying fixations and saccades in eyetracking protocols. In Proceedings of the 2000 symposium on Eye tracking research & applications, pp. 71–78. ACM New York, NY, USA.

6.4 Raw Data Filter

The gaze data received from the eye tracker consists of gaze point coordinates, distance to the eye tracker, pupil size, etc., for the left and right eye separately. The Raw data filter will not classify the data into fixations, but instead it offers the possibility to apply two data processing functions, Gap fill-in (interpolation) and Noise reduction (moving average) to the data.

6.4.1 Gap fill-in (interpolation) – Not default for Raw data filter

The purpose of the Gap fill-in function is to fill in data where valid data is missing. For example, this is to prevent a fixation in which a few samples are missing being interpreted as two separate fixations. Such loss of valid data can occur due to temporary reflections in the participant's eyes or glasses, etc. In these cases the data loss is usually limited to a short period of time, typically less than 50 ms. Data can also be lost due to legitimate reasons such as the participant blinking or looking away. These kinds of data losses usually result in data gaps longer than 100 ms. Losing data in these latter cases may be perfectly fine for applications of eye tracking where attention is measured since participants do not see anything while blinking or looking away anyway.

The Tobii Studio user can control the limit of how large the gaps of data that should be filled-in are by setting the parameter "Max gap length". The default value of "Max gap length" is 75 ms, which is between the two data loss scenarios just mentioned above. According to Komogortsev et. al (2010), minimum blink duration is 75 ms.

Data is filled-in in the data gap through linear interpolation. Data points are added along a straight line between neighboring valid data points. Interpolation is done for each eye separately.

Komogortsev et. Al. 2010. Standardization of Automated Analyses of Oculomotor Fixation and Saccadic Behaviors. IEEE Transactions on Biomedical Engineering, vol. 57 (11), pp. 2635-2645.

6.4.2 Noise reduction

6.4.2.1 MovingAverage – Not default for Raw data filter

All measurement systems, including eye trackers, experience noise. Noise can come from imperfections in the system setup as well as from influences and interferences from the environment in which the measurement takes place. In eye tracking research where the fixation is the eye movement of interest, other minor eye movements such as tremor, and microsaccades (Yarbus 1967) can also be seen as noise. In the most basic form, I-VT filters calculate the velocity by multiplying the change in position between two consecutive sample points with the sampling frequency. If the sampling frequency is low, the eye will have time to do quite large shifts of direction between two samples which makes it easy for the eye tracker to distinguish between real eye movements and noise. The higher the sampling frequency is, the smaller the eye movement will be between two consecutive samples at a given eye velocity. Noise will therefore have a greater impact in a high frequency system even though it has the same magnitude as in a low frequency system.

The *Noise reduction (moving average)* function is a symmetric moving average filter. It produces output data by creating an arithmetic mean of a number of data points from the input data. The number of input data points used to produce each output point is controlled by the *Window size* parameter. Each produced output data point is given the timestamp of the input data point that was in the center of the window: the input median point (the window size parameter must be an odd number). The window size is dynamically adjusted so that the window never stretches outside the valid data series.

The default value of the Window size parameter is 3 samples, which is the lowest possible value having an effect on the data. Always use the VelocityChart application to examine the noise reduction effects while applying and adjusting the parameters in the Noise reduction function.

Yarbus L. 1967. Eye Movements and Vision. Translated from the Russian edition (Moscow, 1965) by Basil Haigh. Lorrin A. Riggs, Translation Ed. Plenum, New York, 1967. xiv + 222 pp.

6.4.2.2 MovingMedian

The Moving Median noise reduction function is accessible using the I-VT fixation filter and the Raw data filter.

Statistically, the moving average function is optimal for recovering eye movement data in the eye tracking data series if the fluctuations are normally distributed, such as noise around a fixation. However, a normal distribution does not place high probability on large deviations, which occur once a saccade take place. This explains why the edge between a fixation and a saccade will be disproportionally smoothed in the output data. If the fluctuations are instead assumed to be Laplace distributed, the moving median is statistically optimal. For a given variance, the Laplace distribution places higher probability on rare events such as saccades than does the normal. This explains why the moving median noise reduction function tolerates saccades better than the moving average noise reduction function and why the median noise reduction filter better preserves the amplitude of the saccade velocity.

The median noise reduction function is a symmetric moving median filter. It produces output data by calculating the median value of a number of consecutive data points from the input data series. The number of input data points used to produce each output data point is controlled by the *Window size* parameter. Each produced output data point is given the timestamp of the input data point that was in the center of the window: the median point of the input window (the window size parameter must be an odd number). In cases where the window is not entirely filled with input data points no output data will be produced. The window may be short of data points due to the fact that the window stretches outside a data series with valid gaze, or small fractions of data points are missing within the window. Typically, the window stretches outside a valid data series at the beginning and end of a blink, or at the beginning and end of a recording. Loss of small fractions of data can occur as a result of temporary reflections, occlusions, etc., and can partly be solved by using the *Gap fill in* function described in *6.4.1 Gap fill-in (interpolation) – Not default for Raw data filter*.

7 Visualizing Eye Tracking Data

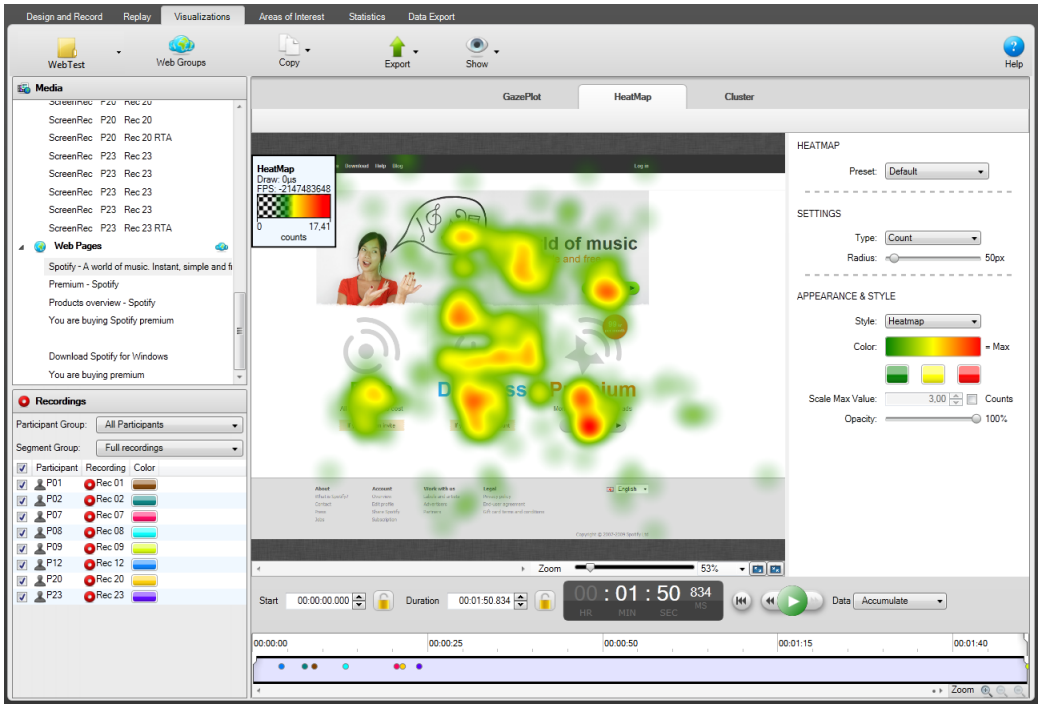
Being able to visualize your data in a number of ways, with gaze superimposed on any kind of stimulus, enables you to make a visual qualitative inspection of your results. Visualizations are easily exported as image files or animated visualizations.

Each of the Visualization types (Gaze Plot, Heat Map or Clusters) is a dynamic representation of the gathered data for the selected recordings on top of a selected media, and can be replayed by simply clicking the Play button on the timeline.

Several recording sessions from multiple test participants can be summarized in a single gaze data visualization, helping to draw conclusions and new hypotheses from the behavior of a group of participants. Effective tools for multi-person analysis, with an option to further filter the participants of a group into categories and also the option of selecting groups of segments created out of multiple recordings for further analysis.

Visualizations also help to illustrate and communicate your results in research papers, reports, and customer or conference presentations.

Some visualizations are only available if you have purchased a specific Tobii Studio version. Please read the *1 Introduction* of this manual to see which visualizations are included in your Tobii Studio license. If you wish to activate a visualization tool, you will need to upgrade to a license of Tobii Studio that includes the tool.



The Visualization tab is divided into the following areas:

- Visualization Header:
  - Test Name — allows you to choose the data to visualize, between the available tests in the current project.
  - Web Groups — allows you to group web pages for analysis. This is applicable only when the selected media is a web element. For more details please read *7.1.1 Grouping web pages*.
  - Copy — allows you to copy to clipboard the visualization image or the list of recordings/segments duration.
  - Export — allows you to export visualizations as image files or movies that show where people have fixated over time. For instructions on exporting visualizations please read *7.8 Exporting gaze plots, heat maps and clusters* .
  - Show — allows you to set the appearance of the legend, AOIs and mouse clicks.
- Selection pane on the left side: This is where you can select the media, recordings, and AOIs used to produce the visualizations.For details read *7.1 Selecting media* and *7.2 Selecting recordings*

- Visualization pane: This is the main area where you can view the different visualizations, view the recording timeline, playback and also change viewing settings.

To create a visualization:

1. In the Selection pane, click a media element in the media list to select it. For details please read *7.1 Selecting media*
2. Now select the Recordings check boxes to include the recordings in the visualization. Clear the check boxes to remove the recordings. For more information on filtering the recordings please read *7.2 Selecting recordings*
3. Click a visualization tab (Gaze Plot, Heat Map or Cluster) to display the results in the Visualization pane. For more information about each visualization type please read *7.4 Creating gaze plots* , *7.5 Creating heat maps* and *7.6 Creating clusters*.
4. Click the Play button to replay the selected recordings. For more details on how to use the timeline please read *7.7 Using the timeline*.
5. You can export the visualizations by clicking the Export button and choosing one of the options according to your needs. For details on how to export visualizations please read *7.8 Exporting gaze plots, heat maps and clusters*

7.1 Selecting media

To select a media for analysis, simply click the media row in the media list and click one of the visualization tabs at the top (Gaze Plot, Heat Map or Cluster).

7.1.1 Grouping web pages

In many cases, a web page will look slightly different each time it is presented during a recording. For example, if looping advertisements are displayed, Tobii Studio registers if the URL changes and presents them in the Web Groups Tool. Using the Web Group Tool, you can group similar pages that contain the object of interest, or group pages that contain small differences that do not impact the analysis if they are grouped together. Web pages saved as a group will be shown as a single media in the media list.

The Web Groups button on the Visualization header opens the Web Group Tool dialog box. This tool is used to group different web pages for analysis. Web pages can either be grouped using predefined criteria, such as by URL, Size, ID, and Name, or can be grouped manually.

When the pages are grouped, the gaze data from all the pages in the group is aggregated and displayed on a single page, selected to represent all the pages. This page is called Group Image. When grouping images, make sure that all pages in the group contain the same data, or that they have the same content for the areas that are important for analysis.

Once web groups are created, the groups will appear in the media list as a single item. This item can then be used to create visualizations and statistics.

7.1.1.1 Automatic grouping using preset criteria

When you perform a web recording, each page visited is recorded automatically by the software. By default, when you open the Visualization tab for the first time after making a recording, the web pages are grouped by Content ID.

The Group Criteria options are located in the top section of the Web Groups Tool dialog box. Below these options you will find two lists. Each list displays all the web frames visited during the web recordings.

When you click a row in the list, a preview of the web page is displayed. These two lists contain exactly the same web frames and web frame information. The two lists allow you to visually compare two web frames and confirm whether the content is the same. This feature also allows you to manually group web pages in a more efficient way, by the use of drag and drop.

To change the grouping criteria:

1. Select one of the Group Criteria options.
   - **URL**: All frames with the same web address will be placed in the same group. The gaze data for the frames will be summarized and shown on one frame. The background image/page is specified by selecting the image/page and clicking the Set As Group Image button.
   - **URL and Size**: If frames have the same web address but different sizes, the frames will be divided into different groups. Gaze data for all frames with the same web address and the same size will be summarized and shown on

one frame. The background image/page is specified by selecting the image/page and clicking the Set As Group Image button.
- **Name**: Pages with the same name are grouped (pages with different URLs can have the same name).
- **Content ID**: Pages with the same URL or name might have different content IDs. Selecting this grouping option will group pages that have the same ID; i.e. that have the same content, look and URL.
- **Manual**: The frames have to be grouped manually.

2. To confirm whether the grouping is valid, click two different web frames (one in each list) belonging to the same group and compare the preview image. If necessary, repeat this procedure for all frames and all the groups. If frames are misplaced and the grouping thus has a strong impact in the quality of your analysis, use another grouping criterion.
3. Set the web group background image by clicking the web frame to select it and clicking the Set As Group Image button.
4. By default, the name of the group is the same as the frame that is used as a background image. Double-click the group row and type a new name for the group if you wish to change it.
5. Click OK to accept the changes and wait while Tobii Studio saves the changes.
6. Each group is displayed in the media list as a single media item.

7.1.1.2 Manual Grouping

If for some reason the frames are constantly misplaced or you want to have better control over the page groupings, you can create the groups manually.

To assign a frame to a group:

1. Select the Manual option and click New Group. The new group appears at the bottom of the web frame lists.
2. Rename the new group by double-clicking it, typing the new name, and then pressing ENTER on your keyboard.
3. Select the frame you want to add to the group. The preview can be seen below the list.
4. Add the frame by dragging it to the new group.
5. Repeat steps 3-4 to add more frames to the group. Before adding another frame to the group, you can compare its content with the frames in the group. Select one frame in each list and use the web page preview to check if the content is the same.
6. Set the web group background image by selecting the web frame and clicking the Set As Group Image button.
7. Click OK to accept the changes and wait while Tobii Studio saves the changes.

7.2 Selecting recordings

You can select the recordings by selecting the check boxes in each row of the Recordings list. By default, the recordings list displays the name of the recording, the color used to identify the recording on the timeline and in the visualizations, and the name of the participant. However, you can display more information and choose the information column to sort the recordings by.

To display more columns of information:

1. Right-click anywhere in the recordings list.
2. Select Show Columns in the context menu.
3. Select the information you want to display on each row.

To sort the list by a particular column:

Click the header of the column you want the list to be sorted by: Participant, Recording, Duration, Samples or Date.

Types of information:

- Recording: ID of the recording
- Date: Shows the time and date when the recording was performed
- Duration: The duration of the recording in seconds
- Color: The color used to identify the recording on the timeline and in the visualizations.

- Samples: The quality of the recording is calculated using the number of eye tracking samples that were correctly identified. 100% means that both eyes were found throughout the recording; 50% that one eye was found for the full recording or both eyes during half the time. Note that the eyes cannot be found when a person is looking away from the screen; this will result in a lower percentage. If the test is performed so that the participant is asked questions during the recording and occasionally looks at a test leader, an alternative method should be considered.
- Participant: The name of the test participant

To change the color of a recording:

1. Click the Color square corresponding to the recording that you want to change the color of. A dialog box is displayed.
2. Select the color for the recording by either selecting one of the Basic Colors in the box that opened or by defining a custom color.
3. Click OK to apply the chosen color to the recording. The color identifies the recording on the timeline and also in the Visualization area.

7.2.1 Using independent variables and segment groups to filter recordings

Filtering allows you to restrict your data to a group of participants. For example, if you have created an independent variable called gender you can produce two separate heat maps for women and men by creating two filters, one for males and another for females. Each filter can be defined by either one independent variable or a combination of independent variables.

You can view, select, create, and manage filters in the Recordings lists of the Visualization tab.

Use the Participant Group or Segments Group drop-down lists located at the top of the Recordings list of the Selection pane to filter the recordings according to participant groups and/or segment groups.

By default, no filters are applied, meaning that the default selections are:

- All Participants — for the Participant Groups
- Full Recordings — for the Segment Groups

To create a new participant group:

1. Click the Participant Group drop-down list. This opens the Participant Groups list.
2. Click Create new participant group. The New Participant Group dialog box opens.
3. Type a group name in the Participant Group Name field.
4. Click an independent variable in the Variables list and select the values you wish to include in the participant group by selecting the check boxes in the Values list.
5. You can choose to filter by one independent variable or a combination of several independent variables (e.g. the group young Danish women can be created by using the independent variable combination age, nationality, and gender). In order to create a multivariable group, repeat step 4 for other variables you wish to use to describe the group.
6. Click OK to create or Cancel to dismiss the new group.

To select a participant group:

1. Click the Participant Group drop-down list button. This opens the Participant Groups list.
2. Under Participant Groups, select an existing group by clicking the group. The list of recordings will be updated automatically, showing only the recordings that fulfill the group conditions.

To edit an existing participant group:

1. Click the Participant Group drop-down list button. This opens the Participant Groups list.
2. Click the Edit button to the right of the group name in the Participant Groups list. This opens the Edit Group... dialog box.
3. Change the group name in the Participant Group Name field.
4. Click an independent variable in the Variables list and select the values you wish to include or exclude in the group definition by selecting the check boxes in the Values list.
5. Repeat step 4 for other variables you wish to change.
6. Click OK to accept or Cancel to dismiss the changes.

To delete an existing participant group:

1. Click the Delete button to the right of the group name in the Participant Groups list.
2. Confirm the deletion by clicking Yes in the Delete Filter dialog box. If you wish to cancel the deletion click No.

To select a segment group:

1. Click the Segment Group drop-down list button. This opens the Segment Groups list. (for more details about Segment Groups read *5.4.3 Grouping Segments*)
2. Select an existing group from a list by clicking the group. The list of recordings will be updated automatically, showing only the recordings that fulfill the group conditions.

7.3 Customizing the appearance of the Legend, AOIs and Mouse Clicks

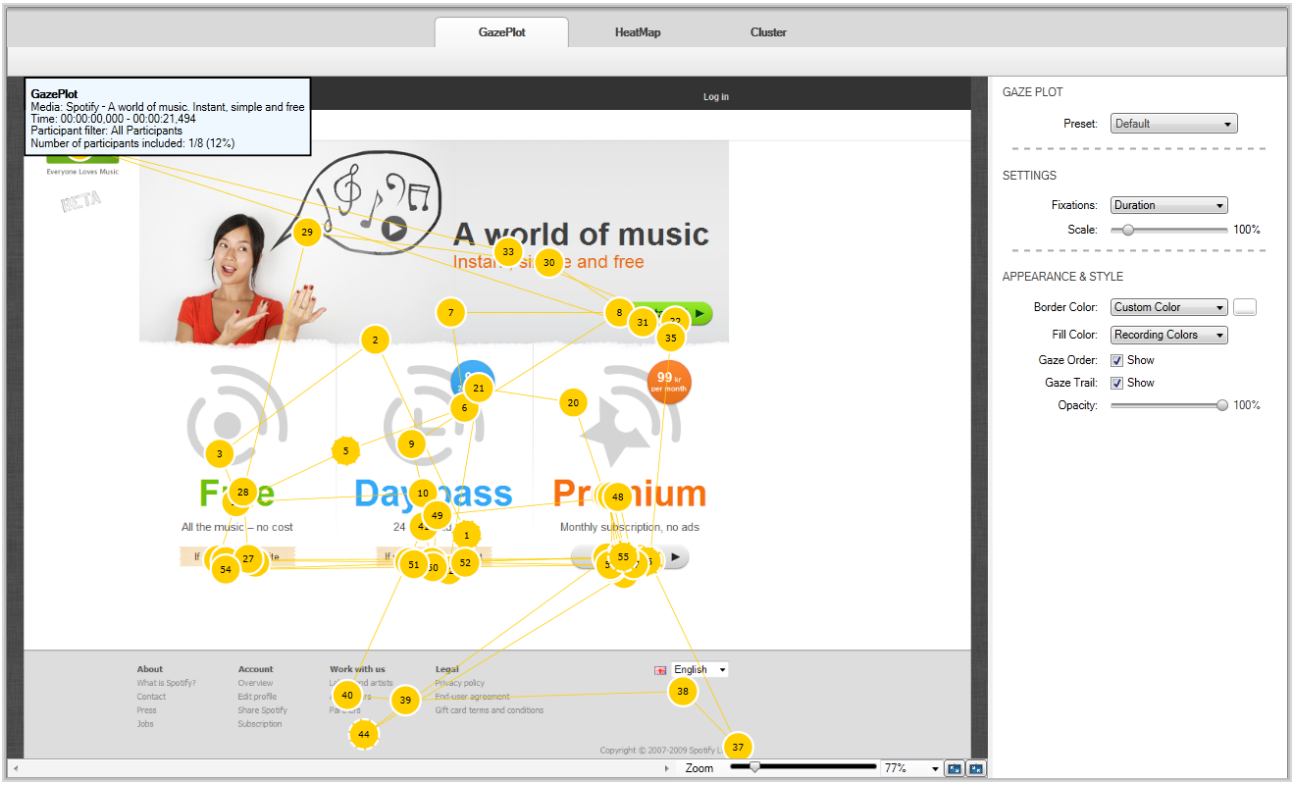
You can choose if you want to display or not, as an overlay on any of the Gaze Plots, Heat Map or Clusters, the Legend box, the AOIs and/or the Mouse Clicks. You can also set the opacity for each one.

To set the appearance of the legend, AOIs and mouse clicks, overlaid on the Gaze Plots, Heat Map or Clusters visualization:

1. Click the Show button on the Visualizations toolbar and click to add a check mark for each item you want to be shown.
2. Click to remove the check mark for the items that you want to remove from the visualization display.
3. Drag the Opacity slide-bar to adjust the opacity view for each item (Legend, AOIs, Mouse Clicks).

7.4 Creating gaze plots

The Gaze Plot visualization shows the sequence and position of fixations (dots) on a static media, (e.g. an image or a scene) or a dynamic media (e.g. a movie or a dynamic website). The size of the dots indicates the fixation duration and the numbers in the dots represent the order of the fixations. Gaze Plots can be used to illustrate the gaze pattern of a single test participant throughout the entire eye tracking session, or of several participants in a short time interval.



To generate a gaze plot:

1. From the media list in the Selection pane, click a media element to select it
2. Select the Recordings check boxes to include the recordings in the visualization. Uncheck to remove the recordings.
3. Click the Gaze Plot tab, to display the fixation plot.
4. For instructions on how to customize the appearance of the gaze plots please read *7.4.1 Customizing gaze plots*
5. You can export the visualization image, the gaze plots image or the animated visualization by clicking the Export button on the Visualizations header. For detailed instructions please read *7.8 Exporting gaze plots, heat maps and clusters*

7.4.1 Customizing gaze plots

You can change the appearance of the gaze plot to customize your image or to give emphasis to a specific part of the information displayed on the fixation dots. Most of these changes can be made in the Settings area on the right side of the screen.

To change the appearance of the gaze plot, in the right side pane:

1. In the Settings area, from the Fixations dropdown list you can choose the size of the fixation dots:
   - Duration — the size of the fixation dots is proportional with the fixation duration.
   - Same size — all the dots have the same diameter.
2. Drag the Scale slider to change the size of the gaze plot fixation points. Each fixation point will be scaled according to its relative size.
3. In the Appearance & Style area, choose the Border Color from the dropdown list:
   - Default — the default border color is the same as the gaze plot color, meaning that the border is not visible by default.
   - Custom Color — click on the colored square next to it and choose the desired border color. When the border is visible, the first and the last fixation of a recording will display a thick line and fixations with dotted lines represent periods when continuous viewing of the media was interrupted. An interruption can take place when, for example, the eye tracker loses track of the eyes (e.g. the participant looked away from the screen), or when the participant leaves and returns to the same media element after viewing another media element in between.
4. Choose the Fill Color:
   - Recording Colors — the gaze plots will have the color of the recording that they belong to.
   - Same Color — all the gaze plots will be of the same color that you can choose by clicking on the color square next to the dropdown list.
5. Check/uncheck the Gaze Order checkbox to display/hide the fixation order number of the fixation dots.
6. Check/uncheck the Gaze Trail checkbox to display/hide
7. Drag the Opacity slider to change the fixation dot opacity.

You can save a custom configuration of all the settings described above, in order to use it at a later time without having to set each parameter manually again.

To save the customized settings:

1. Select the parameter values as desired, according to the steps described above.
2. In the right-side panel, from the Preset dropdown list, slect Save New Preset. A dialog opens.
3. Type in the name for the new set of customized settings and click Save. You will be able to see the new name under the Preset dropdown list and you will be able to load it directly by selecting it .

To load a predefined set of parameters:

1. From the Preset dropdown list in the right side panel, click to select the desired set of parameters.
2. The parameter values corresponding to the selected preset will be loaded automatically.

One of the default presets for Clusters is Bee Swarm — for details, please read *7.4.2 Creating Bee Swarms*

Gaze plots are dependent on the fixation filters settings. Fixation filters are responsible for determining the size and location of the fixation dots (read more about fixation filters in *6 Defining fixations*).

7.4.2 Creating Bee Swarms

The bee swarm visualization is a dynamic representation of the fixations of one or a group of participants on top of a selected media. The fixation of each participant is illustrated with a colored dot. This type of visualization can be used to show or analyze how the overall distribution of fixations changes over time. Bee swarm visualizations can be applied directly to video (movie) stimuli, without the need of creating a set of scenes.

To create a bee swarm:

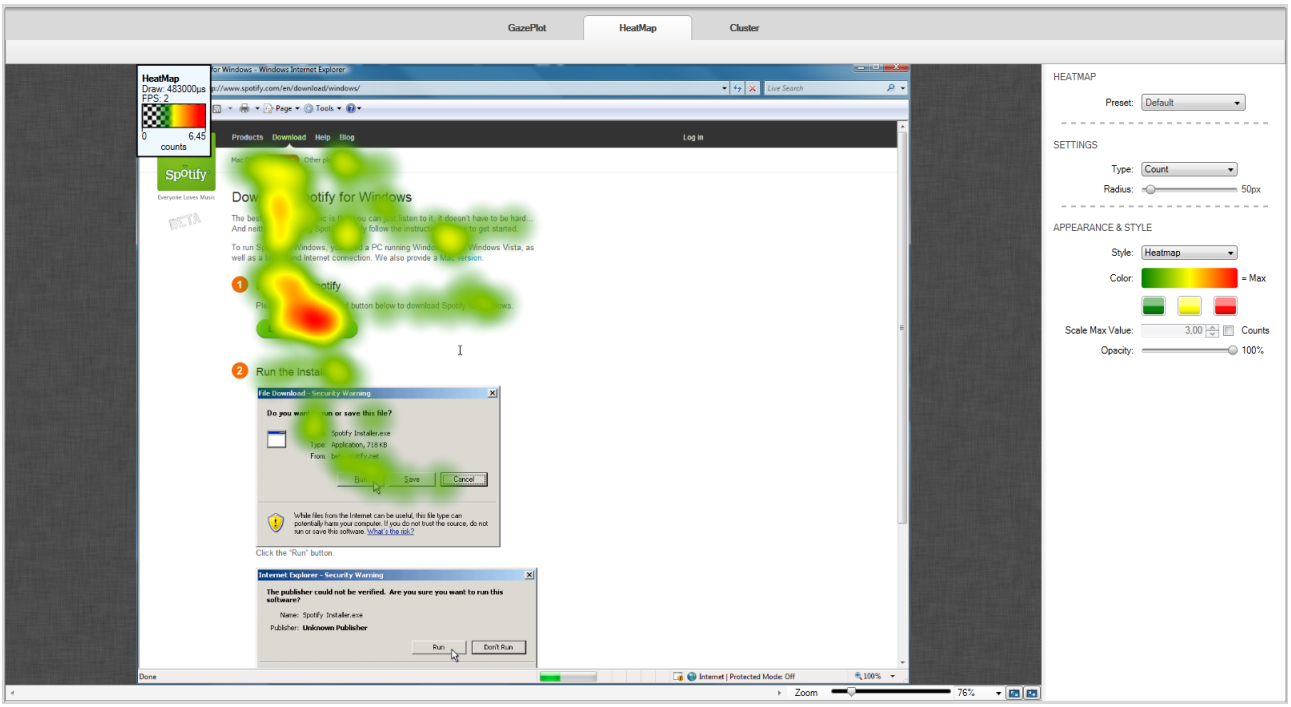
1. In the Visualization area, click the Gaze Plot tab.
2. In the media list, click a media element to select it.
3. Select the Recordings check boxes to include the recordings in the analysis (or clear the check boxes to remove the recordings).
4. From the Preset dropdown list on the right side panel, choose Bee Swarm.
5. Click the play button to start the bee swarm video. Use the stop and pause buttons to control the playback of the recording.

Being a preset of Gaze Plots, you can customize the Bee Swarms, just as you customize a gaze plot— read *7.4.1 Customizing gaze plots*

7.5 Creating heat maps

Heat maps can be of great value when creating reports, papers or presentations, as they help you to summarize large quantities of data in an intuitive way. A heat map uses different colors to show the number of fixations participants made in certain areas of the image or for how long they fixated within that area. Red usually indicates the highest number of fixations or the longest time, and green the least, with varying levels in between. In spite of its intuitiveness, the task of interpreting a heat map is more complex than it seems. For a critical discussion on how to interpret heat maps please read Bojko's (2009) paper entitled *Informative or Misleading? Heatmaps Deconstructed*.

Bojko A. (2009). *Informative or Misleading? Heatmaps Deconstructed, in: Human-Computer Interaction, Part I*, HCII 2009. Jacko J. A. (Ed.). Springer-Verlag Berlin, pp 30-39.



To create a heat map:

1. In the media list, click a media element to select it.

2. Select the Recordings check boxes to include the recordings in the analysis (or clear the boxes to remove the recordings).
3. Click the Heat Map tab, to display the heat map.
4. For instructions on how to customize the appearance of the heat map please read *7.5.1 Customizing heat maps*
5. You can export the visualization image, the heat map image or the animated visualization by clicking the Export button on the Visualizations header. For detailed instructions please read *7.8 Exporting gaze plots, heat maps and clusters*

7.5.1 Customizing heat maps

Tobii Studio can produce three different types of heat maps depending on which eye movement information you wish to focus on:

- Count (total number of fixations) — Count heat maps show the accumulated number of fixations calculated from all the selected recordings for the selected time interval (selected from the timeline), and can be used, for example, to determine whether participants have seen different elements on a stimulus image or website. Each fixation made by each participant adds a color value to the fixation map and the value is the same regardless of its duration.
- Absolute duration (based on fixation durations) — Absolute Duration heat maps display the accumulated fixation duration on different locations in the image and can be used, for example, to measure the amount of attention, or cognitive processing, dedicated to different elements in the stimuli. Each fixation made by each participant adds color values to the fixation map according to its duration (in seconds).
- Relative duration (fixation duration divided by the stimuli viewing time in each recording) — The Relative Duration heat map displays the accumulated fixation duration on the different elements in the image, relative to the total image viewing time. In other words, if in recording A the participant looked at the image for 10 seconds and at a specific object for 3 seconds, and in recording B the participant looked at the image for 10 minutes and at the specific object for 3 minutes, then the data from recording A and recording B will have the same weight on the final heat map. This type of heat map should be used when the view time per stimulus is not fixed, such as during a web usability study where participants typically spend different amounts of time on each web page. Each fixation made by each participant adds a duration value to the fixation map and the values are divided by the participant's view time. The relative values for each participant are then added and the maximum value will be used to apply the color distribution mapping (for more details read *7.5.2 How are heat maps calculated?*).

To change the variable represented in the heat map:

1. On the right side pane, in the Settings area, from the Type dropdown select one of the options:
   - Count — is calculated by the number of fixations
   - Absolute duration — is calculated by the duration of fixations
   - Relative duration — is calculated by the duration of the fixations relative to the total time spent by the participants on the selected media.

To change the heat map style and color:

1. In the Settings area on the right side panel, drag the Radius slider to change the value for the Kernel size (width of the color mapping around a single fixation). The default value is 50 pixels. Read *7.5.2 How are heat maps calculated?*, before you make any changes to this setting.
2. In the Appearance & Style area on the right side panel, click the Style drop-down list to select whether you want to use:
   - Heatmap — The colored heat map uses a color gradient to display the areas with more or longer fixations.
   - Gaze Opacity — uses a transparency gradient. The gaze opacity shows the parts of the media with the highest counts or longest fixations and shades the rest of the media.
3. Click one of the three color boxes under Color to change the colors of the heat map gradient. The box on the left represents few fixations while the box on the right represents more fixations. The Alpha Gradient Settings dialog box will open if gaze opacity was selected. The number on the left represents few fixations and the number on the right represents more fixations. The numbers can range from 0-255 with 255 being opaque and 0 having no opacity.
4. Drag the Opacity slider to change the heat map's general opacity.

You can save a custom configuration of all the settings described above, in order to use it at a later time without having to set each parameter manually again.

To save the customized settings:

1. Select the parameter values as desired, according to the steps described above.

2. In the right-side panel, from the Preset dropdown list, select Save New Preset. A dialog opens.
3. Type in the name for the new set of customized settings and click Save. You will be able to see the new name under the Preset dropdown list and you will be able to load it directly by selecting it .

To load a predefined set of parameters:

1. From the Preset dropdown list in the right side panel, click to select the desired set of parameters.
2. The parameter values corresponding to the selected preset will be loaded automatically.

Like gaze plots, heat maps are dependent on the fixation filters settings. Fixation filters are responsible for determining the number, size and location of the fixation dots (read more about fixation filters in *6 Defining fixations*).

7.5.2 How are heat maps calculated?

The heat map can either be based on fixation data or raw data, depending on if you are using one of the fixation filters or the raw data filter. In both cases the data entries consist of a timestamp, duration, and spatial location (X and Y coordinates) information.

Eye tracking raw data is composed of fixation and noise data points. The noise includes eye samples during saccades and other small fixation-related movements. Thus a heat map based on raw data will contain more noise and show larger areas with the high color value. When a heat map is based on raw data, each entry corresponds to a raw gaze point from the eye tracker, sampled every 3.3 to 33 ms (depending on the sampling data rate of the eyetracker). The duration values for each entry are constant as they are defined by the duration of the sampling interval.

When the input is based on fixation data, the eye tracker will group the raw data entries into fixations and the duration of each fixation depends on the fixation filter used to identify the fixations. The input data will typically look like this:

Fixation: 1 Start: 132 ms Duration: 132 ms Location: (415,711)

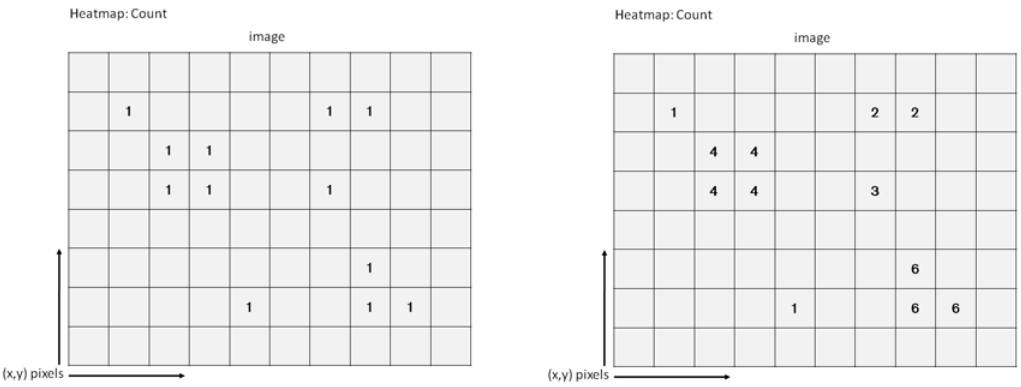
Fixation: 2 Start: 264 ms Duration: 735 ms Location: (711,491)

Fixation: 3 Start: 999 ms Duration: 101 ms Location: (301,10)

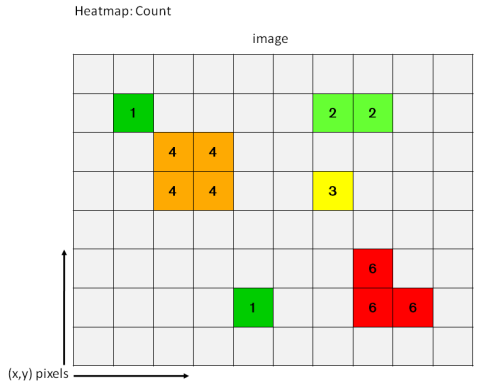
.....

7.5.2.1 Basic concept

The first step in creating a heat map is to map the fixation on the stimuli. This is done by going through all the fixations in all the selected recordings one by one, and adding their values whenever a fixation shares the same X and Y pixel location as another (see the figures below). If we chose Count, we add the number of fixations at the same location. If we are using Absolute duration we add the duration of each fixation. For Relative duration, the duration of each fixation is divided first by the media viewing time and then added.



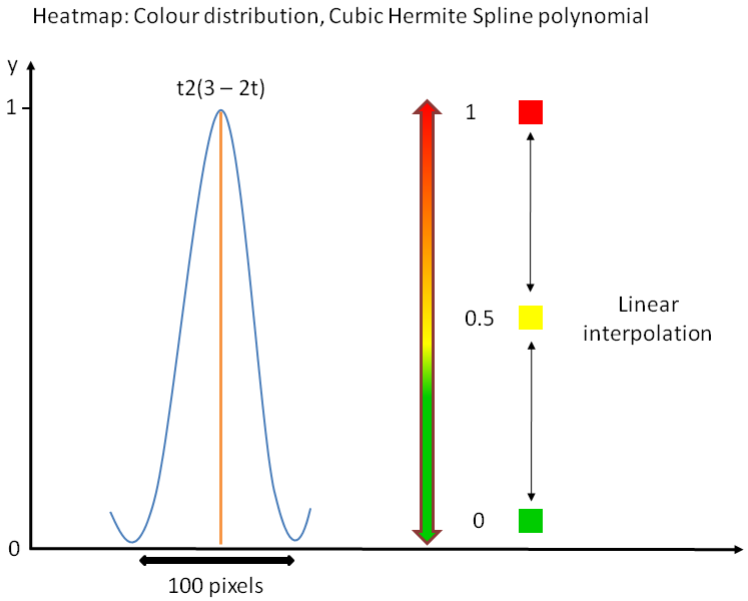
Once all the fixations values have been added together, color values are added to all the points, with the warmest color representing the highest value.



However, this basic process would result in a rather useless image, with small colored dots distributed over the image. What we do instead is add color values to all the points within a certain distance of the fixation location and the color values gradually decrease as we move away from the fixation point. This process ensures that the color distribution results in a more "smooth" heat map image and gives some biological relevance to the color mapping.

7.5.2.2 Tobii Heat Map

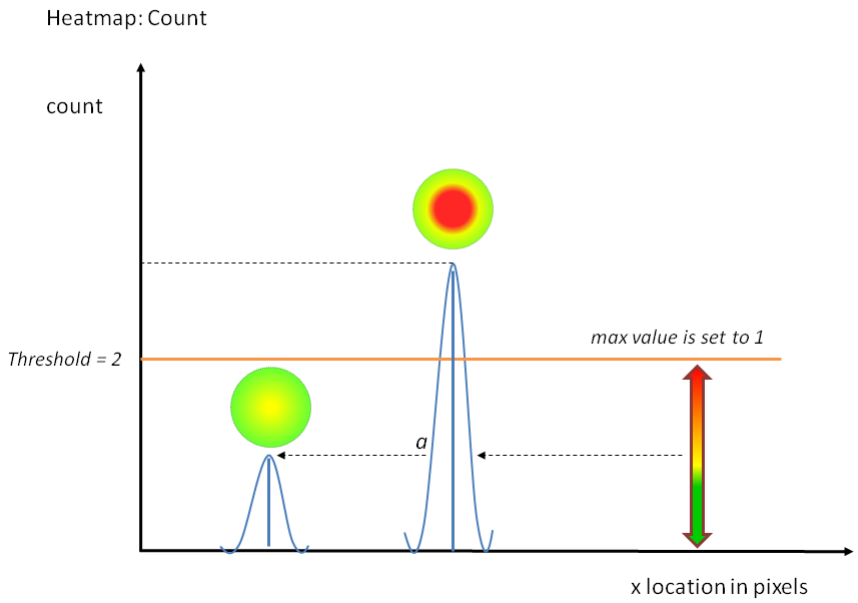
The distribution of values around a fixation point is accomplished by using an approximation to the Gaussian curve that is commonly used in 2D image processing - a Cubic Hermite Spline polynomial (cspline). The specific function of the polynomial that is used is t2(3 - 2t) – represented by the blue line in the graph below. (The orange line represents the fixation point and thus the maximum color value.)



The radius of the function can be adjusted from the Settings panel on the right side of the window, and is set by default at 50 pixels, corresponding to a total kernel of 100 pixels. This default kernel was calculated to reflect the human visual field, i.e. the fact that the human eye has the highest visual acuity at the fovea and that the acuity decreases as we move away from this spot on the retina. For example, when we focus on a word in a text, we are able to read the word and its immediate neighbors, but not words a few centimeters away.

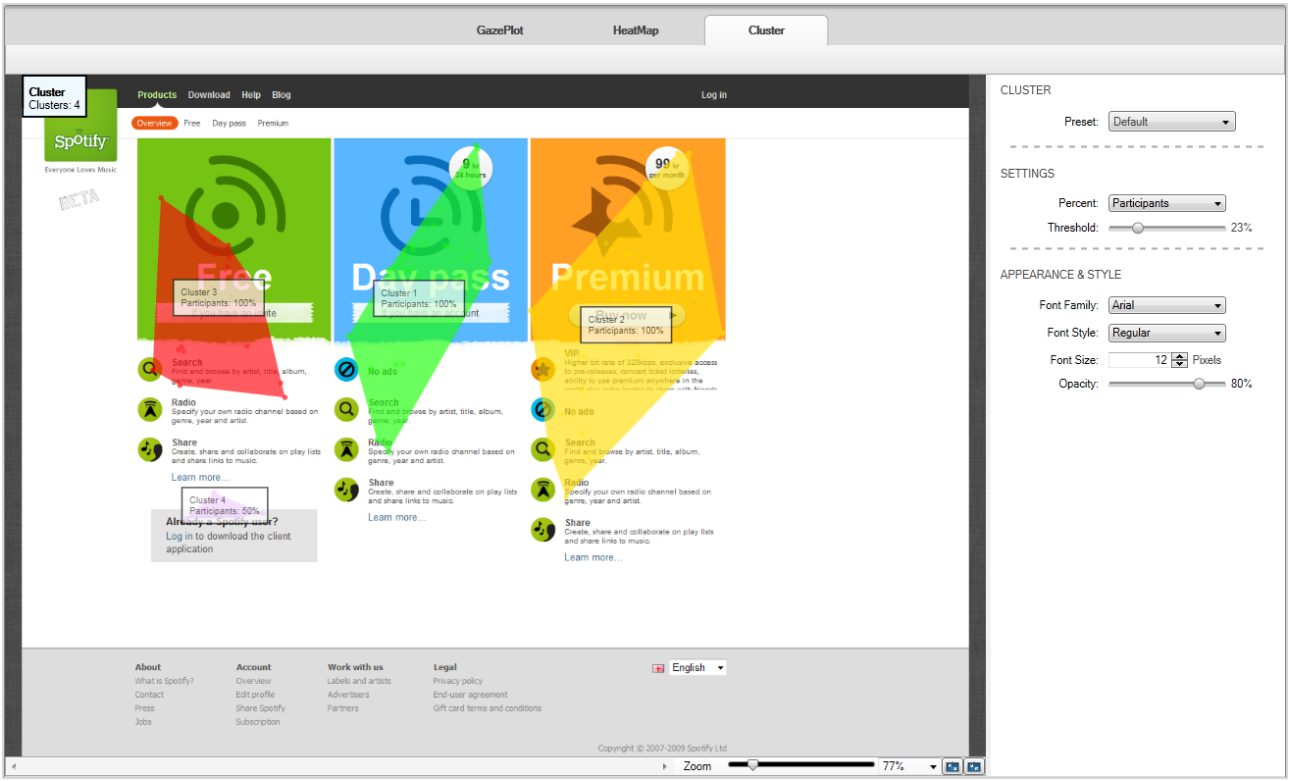
Since the kernel is set in pixels, Tobii heat maps are dependent on screen resolution and less representative of the individual's foveal vision if the participant varies his distance greatly to the stimulus. The current kernel size is optimized for the Tobii T Series Eye Trackers' standard screen resolution (1280x1024) and the typical distance from the participant to the eye tracker screen (64 cm).

Tobii heat map calculations using fixation count (for Absolute and Relative duration the calculations are the same, however instead of using the number o fixations as values, we use the fixation duration or fixation duration/media viewing time, respectively):



7.6 Creating clusters

The Cluster visualization is a graphic representation of areas with high concentrations of gaze data points (clusters), superimposed on a background image. This type of visualization can be used to calculate clusters of raw gaze data that indicate regions of interest, or similarly to Count, heat maps display the areas with a high fixation density. The fixation data contained in each cluster can be further analyzed by automatically generating AOIs and calculating eye tracking metrics based on those AOIs.



To create a cluster visualization:

1. In the Media list, click a media element to select it.
2. Select the Recordings check boxes to include the recordings in the analysis (or clear the check boxes to remove the recordings).
3. Click the Cluster tab, to display the cluster.
4. For instructions on how to customize the appearance of the clusters please read *7.6.1 Customizing clusters*
5. You can export the visualization image, the clusters image or the animated visualization by clicking the Export button on the Visualizations header. For detailed instructions please read *7.8 Exporting gaze plots, heat maps and clusters*
6. Generate AOIs based on clusters by right-clicking the cluster image and selecting Export Clusters to AOIs. The new AOIs will be displayed in the Areas of Interest list.

7.6.1 Customizing clusters

The size and number of clusters in the image are affected by the Distance threshold settings. The Distance threshold parameter is a spatial value that determines the minimum distance between two different clusters (for more details, read *7.6.2 How are clusters calculated?*).

To change the percent information and the distance threshold:

1. In the Settings area on the right side panel, choose from the Percent dropdown list one of the following:
   - Participants — displays the percentage of participants that have contributed with gaze data to the cluster.
   - Recordings — displays the percentage of recordings that have contributed with gaze data to the cluster.
2. Drag the Threshold slider to set the distance threshold.

To change the font of the labels:

1. In the Appearance & Style area on the right side panel, choose the font from the Font Family dropdown list
2. Select the Font Style
3. Set the Font Size, by typing the value or by using the arrow buttons.

To change the cluster image opacity:

1. In the Appearance & Style area on the right side panel, drag the Opacity slider.

You can save a custom configuration of all the settings described above, in order to use it at a later time without having to set each parameter manually again.

To save the customized settings:

1. Select the parameter values as desired, according to the steps described above.
2. In the right-side panel, from the Preset dropdown list, slect Save New Preset. A dialog opens.
3. Type in the name for the new set of customized settings and click Save. You will be able to see the new name under the Preset dropdown list and you will be able to load it directly by selecting it .

To load a predefined set of parameters:

1. From the Preset dropdown list in the right side panel, click to select the desired set of parameters.
2. The parameter values corresponding to the selected preset will be loaded automatically.

Like gaze plots and heat maps, clusters are dependent on the fixation filters settings. Fixation filters are responsible for determining the number, size, and location of the fixation dots. Read more about fixation filters in *6 Defining fixations*.

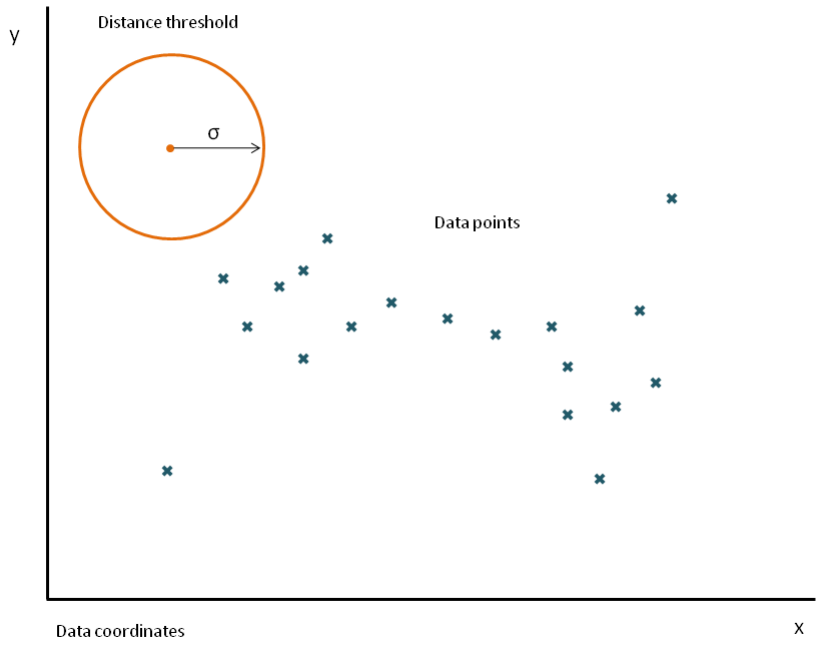
7.6.2 How are clusters calculated?

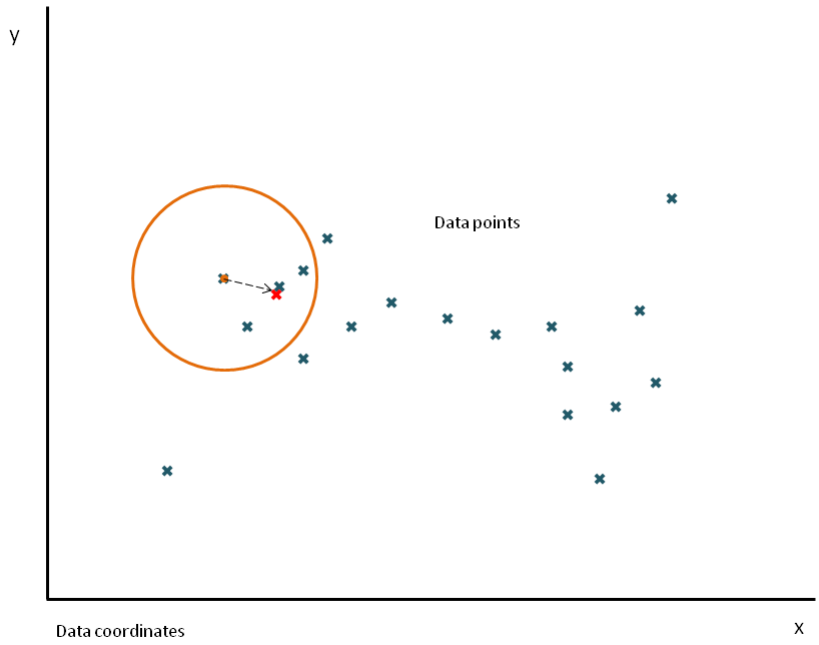
Simple clustering algorithms calculate the distance between any two points in the data and allocate them to the same cluster if the distance is below a certain pre-determined threshold (such algorithms are known as distance cluster algorithms). The algorithm behind the Tobii Cluster visualization is based on the robust clustering algorithm suggested by Santella & DeCarlo (2004) for eye movement data analysis. Essentially, the cluster algorithm tries to find spatial patterns in the distribution of the gaze data. It does so by first moving the gaze points into denser configurations until the points are collected around mode values, and then after a number of iterations when the distances between the mode values are larger than the distance threshold, it assigns each gaze point located around the same mode value to the same cluster.

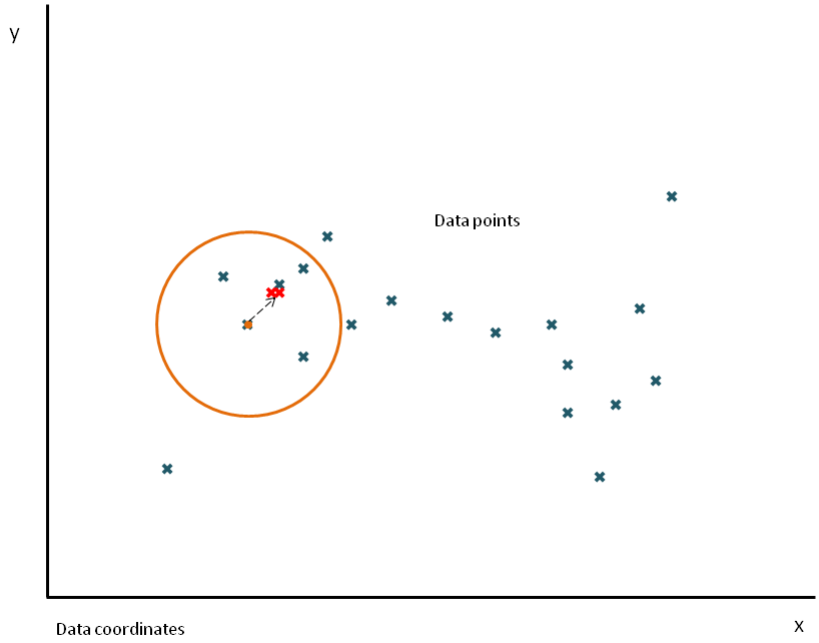
This procedure is summarized in the following algorithm, where σ represents the distance threshold (or spatial scale).

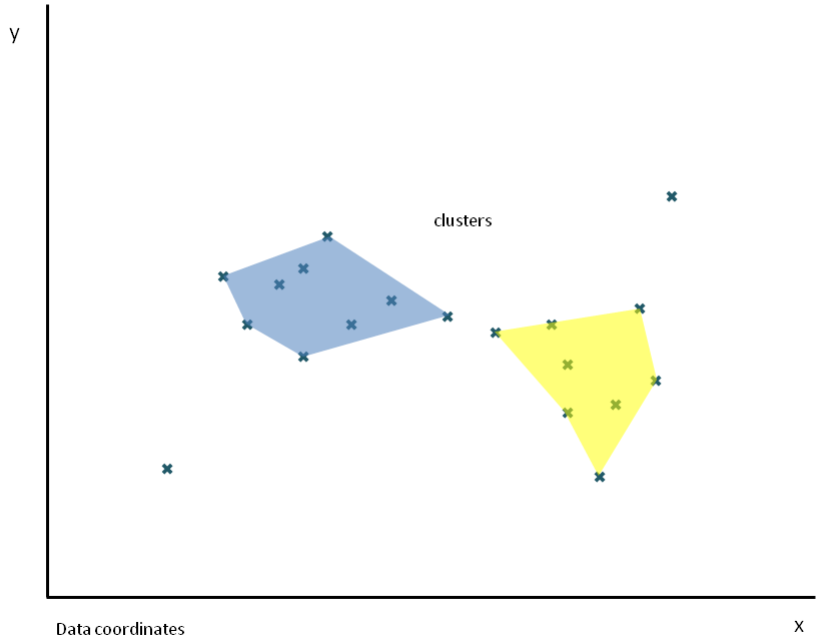
$$\text{Spatial Kernel } (x_i, y_i) = \exp\left(-\frac{x_i^2 + y_i^2}{\sigma_s^2}\right)$$

Cluster calculation:


y
Distance threshold
σ
Data points
Data coordinates
x


y
Data points
Data coordinates
x





This method of cluster determination ensures that the determination of the clusters is not heavily influenced by noise and outliers. The other advantage of using this method is that given the choice of threshold, its results are intuitive and predictable. For example:

- Distant outliers will be represented as small clusters, or discarded if no other neighboring point is present at the current threshold distance.
- Large regions of uniform density of gaze data points will display one cluster.

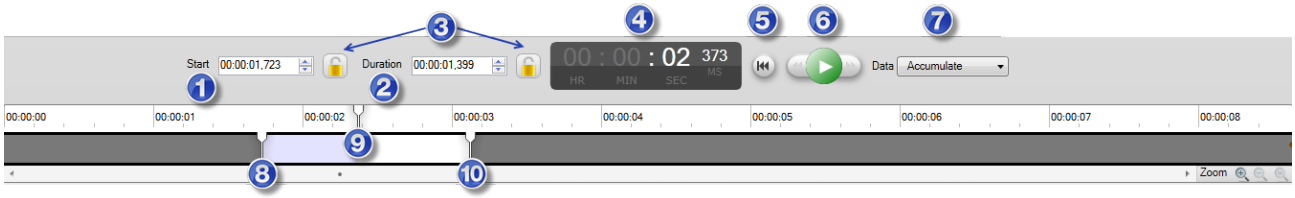
- In areas where there is a bimodal distribution of gaze data points, the cluster visualization will show a single cluster if the modes for each distribution are within the selected threshold distance and 2 clusters if the modes are further apart than the threshold distance.

A. Santella and D. DeCarlo. 2004. *Robust Clustering of Eye Movement Recordings for Quantification of Visual Interest*. In *Proceedings of the 2004 symposium on Eye tracking research & applications*, pages 1–8. ACM New York, NY, USA.

7.7 Using the timeline

The timeline below the visualization shows the total time the media was displayed during the recording. If the participants have different view times (e.g. when browsing a website or a PDF document) the longest view time is used to determine the timeline scale. The duration of each individual recording is indicated by a colored dot that is coded with the color shown next to the recording in the Recordings list.

You can see below the image illustrating the timeline and its main components together with their description:



1. Start — the point from where to start including the gaze data in the visualization.
2. Duration — the time length for which the gaze data will be included in the visualization, counted from the Start point.
3. Lock icons — used for setting a same value for the Start and/or Duration for each recording and media. If you set a Start time and then lock it, when choosing a different recording from the list or a different media, the Start value stays the same. Please note that if you have locked one of the Start or Duration, you can still modify their respective values.
4. The current time — displays the current time, counting from the beginning of the recording for which the data is currently displayed. For the Accumulate (see step 7 below), the data included is from the Start point to the Current time. For the Sliding Window (see 7) the interval being visualized is the duration of the sliding window to the current time.
5. Go to Start — click this button to set the current time and current time needle (9) to the Start time.
6. Playback buttons — used to play/pause the visualization and to go to the previous/next frame (using the backward and forward buttons).
7. Select the data source interval:
   - Accumulate — displays the gaze data accumulated from the start time until the current time.
   - Sliding window — the interval length to limit the display of gaze data to a pre-determined time interval throughout the playback. This interval is set by clicking the field and typing a value in seconds.
8. Start time needle — positioned at start time.
9. Current time needle — marker of the current time. The value is displayed at item 4.
10. Stop time needle — the point in time up to which the gaze data is visualized.

7.7.1 Selecting data from a time interval

You can choose to restrict the data used to create the visualization according to a time interval. For example, you can create a heat map showing the fixations made during the first 2 seconds of the stimulus display. The interval can be determined in two different ways. The first way is by dragging the markers on the visualization timeline, and the second is by setting the Start and Length time values in the respective fields.

To set the time interval using the timeline markers:

1. Drag the Start time needle (no. 8 in the above image) to set the start of the data interval.
2. Drag the Stop time needle (no. 10 in the above image) to set the end of the data interval.

To set the interval using the Start and Duration fields (more precise):

1. Click in the Start field below the visualization and type the hh:mm:ss.ms values to set the start of the interval. Alternatively, you can use the arrows in the field to increase or decrease the time values. The time format is hours:minutes:seconds.milliseconds.
2. Set the duration of the interval by clicking in the Duration field and typing the hh:mm:ss.ms values. As in the Start field, you can use the arrows in the field to increase or decrease the time values.
3. Lock/unlock the Start and Duration values by clicking the corresponding lock icon — used for setting a same value for the Start and/or Duration for each recording and media. If you set a Start time and then lock it, when choosing a different recording from the list or a different media, the Start value stays the same. Please note that if you have locked one of the Start or Duration, you can still modify their respective values.

By selecting a smaller time window, some recordings might be excluded from the visualization altogether.

7.8 Exporting gaze plots, heat maps and clusters

Visualizations can be exported as image files or as animated movies that show where people have fixated over time.

To export a visualization image:

1. Click the Export button on the Visualization header and select one of the following:
   - Visualization Image — exports an image of the current media background together with the selected visualization (heat map, gaze plot, or cluster) as an overlay.
   - Visualization Layer Image — exports an image of the current selected visualization (heat map, gaze plot, or cluster) on a transparent background.
2. In the Save Image dialog box, select the folder and type the file name.
3. Select the type of image file – JPEG or PNG – and then click Save.

To export an animated visualization to an .avi file:

1. Click the Export button on the Visualization header and select Animated Visualization. This is available for gaze plots, heat maps and clusters. You can create a video (AVI) with animated gaze plots, heat maps, or clusters overlaid on a static image or a video.
2. In the Save Image dialog box, select the folder and type the file name.
3. Click Save. The movie file is exported and a notification box appears. Click Open output folder to browse for the exported file, or click Done to close it.

To export a list of the Recording/Segment Durations to a .txt file:

1. Click the Export button on the Visualization header and select Recording/Segment Durations.
2. In the Save Image dialog box, select the folder and type the file name.
3. Click Save. A .txt file is created, containing a list of all the recording/segment durations.

7.8.1 Batch export

You can use this feature to batch export visualization image files with multiple participant filters from only the current media, from all the media within a single Tobii Studio Test or all the media from all the tests included in the current project.

To batch export visualization images:

1. Click the Export button on the Visualization header and select Batch Export Visualization Images. The Batch Export Visualization Images opens.
2. Select from the Export Scope dropdown list one of the following:
   - Only current selected media.
   - All static media in current test.
   - All static media in current project.
3. Select the Image Format: JPEG or PNG.

4. Select if you want to Export only the Visualization Layer. This option is available only if you have selected PNG as image format at previous step.
5. Choose from the Scale Max Value dropdown list the maximum value used for the color mapping by choosing between two different options (only for Heat Maps):
   - Recalculate for each media — set the maximum independent of the other heat maps being exported (exports with default values).
   - Use current setting for all media — set the value of all exported heat maps the same as the value of the current heat map (value can only be changed and viewed prior to clicking Batch Export).
6. Select the time interval for the export from the Time Selection dropdown list:
   - Use current time selection for all media — to export the visualization using the interval determined by the timeline markers in the visualization pane.
   - Use total duration of each media — to include all the possible data for the media element.
7. Specify if you want to batch export visualizations based on different Participant Groups and/or Segment Groups, by selecting the corresponding checkbox. Tobii Studio exports one visualization for each selected group.
8. Click the File Options button and set if you want to have prefixes automatically added to the filenames and if you want sub-folders to be created automatically for each Project, Test or selected Media.
9. Click the Export button to choose the location for the exported files and click OK. The export operation will be performed and a notification box appears, allowing you to Open the output folder.

To batch export animated visualizations:

1. Click the Export button on the Visualization header and select Batch Export Animated Visualizations. The Batch Export Animated Visualizations dialog opens.
2. Select from the Export Scope dropdown list one of the following:
   - Only current selected media.
   - All static media in current test.
   - All static media in current project.
3. Select the Video Codec to be used to compress the video file from the dropdown list. Click the Edit button next to it if you want to add more codecs to the list
4. Select the frame rate of the video file by clicking in the Framerate field and typing a value (in Frames per Second). Alternatively you can use the arrows in the field to change the value.
5. Choose from the Scale Max Value dropdown list the maximum value used for the color mapping by choosing between two different options (only for Heat Maps):
   - Recalculate for each media — set the maximum independent of the other heat maps being exported (exports with default values).
   - Use current setting for all media — set the value of all exported heat maps the same as the value of the current heat map (value can only be changed and viewed prior to clicking Batch Export).
6. Specify if you want to batch export visualizations based on different Participant Groups and/or Segment Groups, by selecting the corresponding checkbox. Tobii Studio exports one visualization for each selected group.
7. Click the File Options button and set if you want to have prefixes automatically added to the filenames and if you want sub-folders to be created automatically for each Project, Test or selected Media.
8. Click the Export button to choose the location for the exported files and click OK. The export operation will be performed and a notification box appears, allowing you to Open the output folder.

7.9 Copying Visualization Images to Clipboard

The Copy button on the Visualizations tab allows you to copy to clipboard the following:

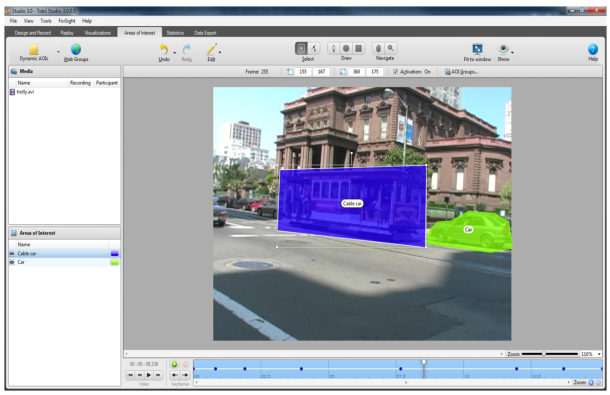
- Visualization Image — an image of the current media background together with the selected visualization (heat map, gaze plot, or cluster) as an overlay.
- Visualization Layer Image — an image of the current selected visualization (heat map, gaze plot, or cluster) on a transparent background.
- Recording/Segment Duration — a list of the currently selected Recordings/Segments and their corresponding durations.

8 Creating and Managing Areas of Interest

The Dynamic AOI tool enables you to define both static and dynamic (moving and transforming) areas of interest (AOI) within a broad range of stimuli, such as images, movies, scene camera videos, screen recording, web pages and web recordings etc. These areas can be analyzed and compared in the Tobii Studio Statistics tool.

AOIs can be grouped together, allowing for accumulation and analysis of data within and across stimuli and tests, as well as more flexible and advanced test design and analysis.

To open the Tobii Studio Areas of Interest tool, click the Areas of Interest tab:



The Areas of Interest tool has six main areas:

- Areas of Interest toolbar – This is where you find tools to create AOIs.
- Media selection pane – This is where you select what media you want to create areas of interest on.
- Areas of Interest pane – This is where you can select Areas of interest and change the appearance of them.
- AOI property bar – This is where you find and change properties of a selected AOI.
- Areas of interest workspace – This is where the media is displayed and where you create the areas of interest.
- Video controls and Timeline – This is where you replay your dynamic media.

With some non-interactive media types such as instruction elements, images and Movie elements, it is possible to create AOIs before recordings have been made. With interactive media types such as web elements, screen recordings and pdf elements, recordings must be made before the media appears in the media list in the AOI tool. For Tobii Glasses recordings where IR markers have NOT been used you need to create AOIs for each participant separately and group the corresponding AOIs to aggregate data. If IR markers have been used, AOIs can be created on snapshots. Data will then automatically be aggregated throughout the selected data set.

The AOIs in Tobii Studio can be:

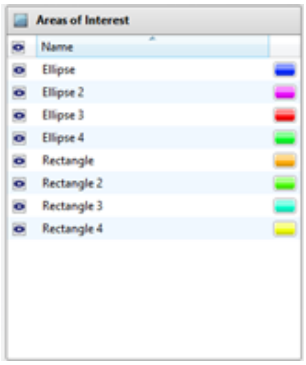
- **Static AOIs** – The shapes of static AOIs in Tobii Studio are drawn by the user. Static AOIs will collect data throughout the entire display time of the media.

To create a static AOI, use the tools and operations described in the following sections.

- **Dynamic AOIs** – The shapes and behaviors of dynamic AOIs in Tobii Studio are defined by so called Keyframes. Each Keyframe is a user defined shape and position of the AOI that corresponds to a certain point on the timeline of the media. Dynamic media containing dynamic AOIs, will typically have numerous Keyframes for each AOI. In-between these Keyframes, Tobii Studio will interpolate the shape and position of the AOI, so that the AOI moves smoothly from one Keyframe to the next. Any changes that are made to an AOI somewhere on the timeline will create a new Keyframe unless you are changing an existing Keyframe.

- The vertices of the AOI shapes will interpolate/move linearly from Keyframe to Keyframe in constant velocity. Transformations such as rotation will therefore have an effect on the AOI size. To minimize these effects, create numerous Keyframes by rotating the AOI shape in small steps.
- During playback of dynamic AOIs in the Tobii Studio Areas of Interest tool, an AOI may appear to be erroneously animated, not aligned with the object in the movie. However, the collection of data will still be correct as long as the AOIs align with the analyzed objects when viewing the media frame by frame.

The order of the AOIs in the AOI list in the AOI tab can be arranged by Name or by Color. This is done by clicking on the column headers (See illustration below).



Dynamic AOIs have user-defined **active** or **inactive** states throughout the timeline. During **active** state intervals the AOI will collect eye gaze data. During **inactive** state intervals the AOI will not collect eye gaze data.

The basic workflow of creating Dynamic AOIs:

1. Draw an AOI around the researched object in the media.
2. Move to a new point on the timeline and edit the AOI shape to create a new Keyframe.
3. Make sure the Activation state is set correctly throughout the timeline.
4. Consider grouping AOIs into groups.

8.1 Drawing AOIs

When you draw AOIs use as many vertices as you need to portray essential parts of the analyzed object throughout the timeline.

To draw an AOI:

1. In the media list, select the relevant media.
2. On the toolbar, select an appropriate drawing tool (Polygon/Ellipse/Rectangle).
3. To draw an AOI, do one of the following:
   - To draw polygons, click where you want the curve to start and then click wherever you want to add vertices. Close the shape by clicking at the first vertex.
   - To draw rectangles or ellipses, click and drag until the shape is the size that you want. To make the shape a perfect square or circle, press and hold SHIFT while you drag to draw.

8.2 Editing the shape of an existing AOI

Whenever you change the shape of a dynamic AOI, it will either change an existing Keyframe, or create a new Keyframe if the shape that is changed is in-between Keyframes. There is no way to add or delete vertices on an existing AOI.

To change the shape of an existing AOI:

1. Make sure the AOI you want to edit is visible (if not, read section *8.12 Showing/Hiding AOIs*).
2. On the toolbar, select the **Select/Move Vertices** tool .
3. Drag the vertices to transform the AOI.

Multiple vertices can be selected and moved simultaneously by creating a selection window, over the vertices and then moving them as a group.

8.3 Changing the time interval in which an AOI collects data (the Activation state of an AOI)

AOIs can be **active** or **inactive** throughout different parts of the timeline. During **active** intervals the AOI will collect eye gaze data. During **inactive** intervals the AOI will not collect eye gaze data. The appearance of the timeline indicates the activation state of a selected AOI. A dotted line indicates that the AOI data collection is deactivated, and a solid line indicates that the AOI data collection is activated. When replaying dynamic media, the inactive AOIs will be hidden during the replay even if the visibility state is set to visible.

To change the time interval in which an AOI is active/inactive (collects data or not):

1. In the Areas of Interest pane, select the appropriate AOI.
2. Drag the time indicator slider to the point in time where you want to change the AOI activation state.

   If the time indicator slider is placed in-between two Keyframes when you change the activation state a new Keyframe will be created. If you place the time indicator slider on top of a Keyframe, the Keyframe will be edited. To move between Keyframes, use the Next/Previous Keyframe buttons next to the media replay control buttons.

3. Change the state of the AOI Activation by selecting or deselecting the Activation check box
   - To activate AOI data collection, select the Activation check box.
   - To deactivate AOI data collection, deselect the Activation check box.

8.4 Basic media replay operations in the Areas of Interest tab

This section describes basic operations that have to do with replaying the media on which you are creating dynamic AOIs. If the media is static, such as an image or a pdf, neither a timeline nor replay controls will be available in the user interface.

You can use Keyboard shortcuts to control the Media replay. Please read section *8.16 Shortcut commands in the Areas of Interest tool*.

8.4.1 Media replay controls in the Areas of Interest tab

To be able to create dynamic AOIs, dynamic media can be replayed in the Areas of Interest tab. The media replay is controlled by the replay control buttons to the left of the media timeline.

To control the media replay:

- To replay the media, click the Play button.
- To rewind the media to its starting point, click the Rewind button.
- To step frame by frame in the media, click the Step backwards or Step forward buttons.
- To jump between AOI keyframes, click the Previous keyframe or the Next keyframe buttons.

8.4.2 Zooming the media timeline

To zoom in or out on the media timeline:

- In the bottom right hand corner of the Areas of Interest tab user interface, click the Zoom in/out buttons to zoom in or out.

The timeline and zoom in/out buttons are only visible when the media type is dynamic.

8.5 Changing the size of an existing AOI

Whenever you change the size of an AOI, it will either change an existing Keyframe or create a new Keyframe if the shape that is resized is in-between Keyframes.

To change the size of an existing AOI:

1. Make sure the AOI you want to resize is visible (if not, read section *Showing/Hiding AOIs*).
2. On the toolbar, select the **Select/Move AOI(s)** tool.
3. Click the AOI that you want to resize. The AOI then lights up and has a rectangle around it with sizing handles in the corners.
4. To increase or decrease the size, drag a sizing handle.

   To maintain the object's proportions, press and hold SHIFT while you drag the sizing handle.

The size of a selected AOI can be adjusted manually entering numbers in property fields on the AOI property bar.

8.6 Moving an existing AOI

Whenever you move an existing AOI it will either change an existing Keyframe or create a new Keyframe if the shape that is moved is in-between Keyframes.

1. Make sure the AOI you want to move is visible (if not, read section *Showing/Hiding AOIs*).
2. On the toolbar, select the **Select/Move AOI(s)** tool.
3. Click the AOI that you want to move. The AOI then lights up and has a rectangle around it.
4. Drag the AOI to its new location. Note: To constrain an AOI so that it moves only horizontally or vertically, press and hold SHIFT while you drag the object.

The position of a selected AOI can be adjusted manually entering numbers in property fields on the AOI property bar.

8.7 Rotating an existing AOI

Whenever you rotate an existing AOI it will either change an existing Keyframe or create a new Keyframe if the shape that is rotated is in-between Keyframes.

For dynamic AOIs, the vertices of the AOI shapes will interpolate/move linearly from Keyframe to Keyframe. Transformations such as rotation will therefore have an effect on the AOI size. To minimize these effects, create numerous Keyframes by rotating the AOI shape in small steps.

1. Make sure the AOI you want to rotate is visible (if not, read section *Showing/Hiding AOIs*).
2. On the toolbar, select the **Select/Move AOI(s)** tool.
3. Click the AOI that you want to rotate. The AOI then lights up and shows a rectangle around it with a rotation handle sticking out.
4. Drag the rotation handle in the direction that you want to rotate the AOI. Note: To constrain the rotation to 45 degree angles, press and hold SHIFT while you drag the rotation handle.

8.8 Adding and deleting AOI Keyframes

Adding and deleting AOI Keyframes is only possible for AOIs on dynamic media.

To manually add a Keyframe:

Keyframes are automatically added whenever you make a change to an AOI shape in-between keyframes.

1. Select the appropriate AOI by clicking either the AOI shape or the name in the Areas of Interest pane.
2. Use the time indicator slider and/or the media replay controls to find the point in time where you want to add the Keyframe.

3. To add a Keyframe do one of the following:

- Click the add Keyframe button
- Right click on the time indicator slider and click **Insert Keyframe.**

If you are positioned on an existing Keyframe for the selected AOI you will not be able to create new Keyframe on top of the old one.

To delete a Keyframe:

1. Select the appropriate AOI by clicking either the AOI shape or the name in the Areas of Interest pane.
2. To select the Keyframe to delete, do one of the following:

- On the timeline, click the colored dot of the Keyframe to be deleted.
- Click the Previous keyframe or the Next keyframe buttons to jump between AOI keyframes.

3. To delete the selected Keyframe, do one of the following:

- Click the delete Keyframe button.
- Press the **DELETE** key on your keyboard.

Keyframes can be deleted by right clicking a Keyframe's colored dot on the timeline and then clicking **Delete**. If doing so while the time indicator slider is not on top of the Keyframe, please remember that the shape of the AOI that you see in the media window is not the same as the shape of the AOI Keyframe that you are deleting.

The Keyframe at time=0 cannot be deleted.

8.9 Changing the name or appearance of an AOI

To change the name or appearance of an AOI :

- To change the name of an AOI, double click the AOI name in the Areas of interest pane and edit the name.

  When an AOI is selected, you can also press F2 to open the Rename AOI dialog.

- To change the color of an AOI, click the AOI color indicator rectangle next to the AOI name in the Areas of interest pane, pick a new color and click ok.
- To change the opacity of the AOIs, click the **Appearance** button in the toolbar and adjust the **AOIs' opacity** slider.
- To show or not show the AOI name labels in the AOIs, click the **Appearance** button in the toolbar and select or deselect the **show AOI names** check box.

8.10 Undoing/redoing actions

To undo the most recent action:

- On the toolbar, click the **Undo** button, or press Ctrl Z.

To undo a number of recent actions:

1. On the toolbar, click the drop-down arrow next the **Undo** button.
2. In the drop-down menu, select the action that you want to undo.

To redo the most recent undone action:

- On the toolbar, click the **Redo** button, or press Ctrl Y.

To redo a number of recent undone actions:

1. On the toolbar, click the drop-down arrow next the **Redo** button.
2. In the drop-down menu, select the action that you want to redo.

8.11 Copying, cutting and pasting AOIs

You can copy, cut and paste existing AOIs. Only the shape of the copied/cut AOI can be pasted, all other properties and behaviors will be lost. The pasted AOI will be **active** from the point in time it was pasted. An AOI can be copied from one media and pasted in another.

To copy and paste the shape of an AOI:

1. Drag the time indicator slider to the point in time from where you want to copy the AOIs shape.
2. Select the **Select/Move AOI** tool on the toolbar.
3. Right click the AOI that you want to cut and click **Copy**. Note: You can right click either the AOI shape in the media, or the AOI name in the Areas of Interest pane.
4. Move the time indicator slider to the point in time where you want to paste the AOI.
5. To paste the copied AOI, do one of the following:
   - To paste the AOI in the middle of the media, right click and click **Paste.**
   - To paste the AOI where the copied AOI was/is, right click and click **Paste in place.**

The fastest way to copy and paste an AOI is to press and hold CTRL while you drag a copy from the AOI that you want to copy. You can also copy and paste AOIs using the Edit menu on the toolbar by right clicking an AOI or through keyboard shortcuts CTRL+C and CTRL+V.

To cut and paste the shape of an AOI:

When you cut and paste an AOI you lose all its Keyframes.

1. Drag the time indicator slider to the point in time from where you want to cut the AOIs shape.
2. Select the **Select/Move AOI** tool on the toolbar.
3. Right click the AOI that you want to cut and click **Cut**. Note: You can right click either the AOI shape in the media or the AOI name in the Areas of Interest pane.
4. Move the time indicator slider to the point in time where you want to paste the AOI.
5. To paste the copied AOI, do one of the following:

- To paste the AOI in the middle of the media, right click and click **Paste.**
- To paste the AOI where the copied AOI was/is, right click and click **Paste in place.**

You can also cut and paste AOIs using the Edit menu on the toolbar or through keyboard shortcuts CTRL+X and CTRL+V.

8.12 Showing/Hiding AOIs

AOIs can be hidden (not visible) or shown (visible). The “visibility state” is not to be mistaken for “Activation state”. A hidden, not visible AOI that is active will still collect data.

During replay, **inactive** AOIs will automatically be hidden.

To hide an AOI:

- In the Areas of Interest pane, deselect the check box of the AOI you want to hide.

To show a hidden AOI:

- In the Areas of Interest pane, select the check box of the AOI you want to show.

8.13 Panning and zooming the media

To pan the media:

Panning the media is only possible if the media is larger than the viewport.

1. Select the **Pan** tool on the toolbar.
2. Drag the media to pan it to its new location.

To zoom the media, do one of the following:

- Select the **Zoom** tool on the toolbar, and click on the media where you want to zoom in.
- On the status bar, slide the Zoom slider to the percentage zoom setting that you want.
- Use CTRL+Mouse Wheel to zoom in or out.
- On the toolbar, click the **Fit to window** / **Actual size** button to swap between 100% and Fit to Screen zoom levels.

8.14 Exporting an image of the AOIs on the media

To export an image of the AOIs on the media:

1. To open the media shortcut menu, right click with the mouse on the media.
2. In the media shortcut menu click **Export Image...** to open the Save As dialog.
3. Locate an appropriate folder then enter a file name and click **Save**.

8.15 Managing AOI groups

All created AOIs have their own identity. This means that AOIs carrying the same name will still be treated as individual AOIs even if they are associated with the same media element. To aggregate data from different AOIs, AOIs must be grouped. AOI groups can group AOIs within a single media as well as across multiple media and across tests. An AOI group is treated as a single AOI in the Statistics view of Tobii Studio. The grouped AOIs can be seen as a single AOI shown in different media and at different times.

To display AOI group labels on AOIs:

1. On the toolbar, click the **Show** drop-down menu button
2. In the drop-down menu, click **Show AOI Groups Names**.

To create an AOI group:

1. Select the AOIs that you want to include in the AOI group that you are about to create.
2. Under the toolbar, click **AOI Groups...**, the AOI groups dialog opens.
3. In the AOI groups dialog, click **New Group**
4. To change the name of the AOI group, double click its name and enter a new name.
5. To change the AOI group indicator color, click the colored rectangle next to the AOI group name, pick a new color and click **OK**.
6. To add the selected AOIs to the created AOI group, tick the AOI group check box and click **OK.**

To add AOIs to one or several AOI groups:

1. Select the AOIs that you would like to add to one or several AOI groups.
2. On the toolbar, click **AOI Groups...**, the AOI groups dialog opens.
3. To add the selected AOIs to an AOI group, select the AOI group check box and click **OK.**

You can select several groups.

If multiple AOIs belonging to different groups are selected, the AOI groups will show as an indicator that not all selected AOIs belong to the AOI group.

To remove an AOI from an AOI group:

1. Select the AOI that you would like to remove from the group.
2. On the toolbar, click **AOI groups...** to open the AOI groups dialog.

3. In the AOI groups dialog, untick the check box of the AOI group that you no longer want the selected AOI to be assigned to.

To delete an AOI group:

1. Select any AOI. (The AOI groups dialog is only accessible if you have selected an AOI)
2. On the toolbar, click **AOI groups...** to open the AOI groups dialog.
3. In the AOI groups dialog, select the AOI group that you want to delete by clicking its name and not the check box.

You can select multiple AOI groups by pressing shift/ctrl while clicking on the AOI groups.

4. Click **Delete** and then click **OK.**

The AOIs will not be deleted.

8.16 Shortcut commands in the Areas of Interest tool

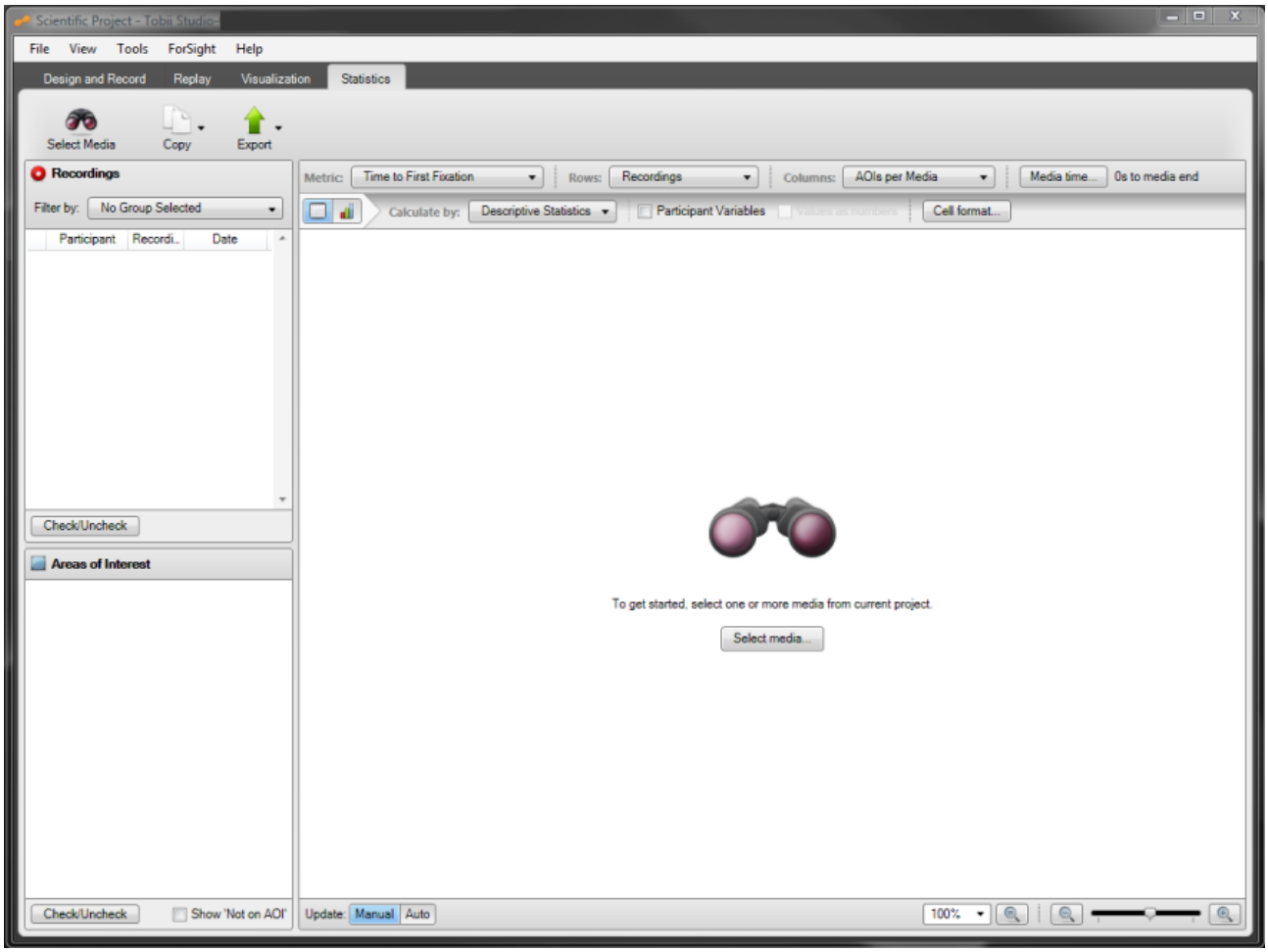
Key	Action
Video Replay control shortcuts	
CTRL + SPACE	Toggle Play/Pause video replay
CTRL + B	Step back 1 video frame
CTRL + F	Step forward 1 video frame
CTRL + SHIFT + B	Step back 5 seconds
CTRL + SHIFT + F	Step forward 5 seconds
CTRL + R	Rewind video replay
ALT + B	Go to previous AOI Keyframe (Selected AOI)
ALT + F	Go to next AOI Keyframe (Selected AOI)
AOI Shortcuts	
ALT+B	Go to previous AOI Keyframe (Selected AOI)
ALT+F	Go to next AOI Keyframe (Selected AOI)
DELETE	Deletes selected AOI
F2	Opens the Rename AOI dialog for selected AOI
CTRL+A	Select all AOIs
CTRL+C	Copy selected AOI(s)
CTRL+X	Cut selected AOI(s)
CTRL+V	Paste AOI in center
CTRL+Shift+V	Paste AOI in place
General Interface Shortcuts	
CTRL+Z	Undo last action
CTRL+Y	Redo last Undo
CTRL+MOUSEWHEEL	Zoom in/out around mouse cursor
SPACE (HOLD)	Pan media
C	Toggle AOI Active state
G	AOI Groups dialog

Key	Action	
W	Web Groups dialog	
U	Undo last action	
O	Redo last Undo	
I	Edit menu	
S	Select AOI(s) Tool	
V	Select Vertices Tool	
P	Polygon Tool	
E	Ellipse Tool	
R	Rectangle Tool	
H	Pan Media Tool	
Z	Zoom Tool	
F	Toggle Fot to Window/100%	
A	Appearance menu	
Video Replay control shortcuts after video control buttons have been clicked with the mouse		
LEFT ARROW		Step back 1 video frame
SHIFT+LEFT ARROW		Step back 1 second
ALT+LEFT ARROW		Step back 5 seconds
CTRL+LEFT ARROW		Step back 60 seconds
RIGHT ARROW		Step forward 1 videoframe
SHIFT+RIGHT ARROW		Step forward 1 second
ALT+RIGHT ARROW		Step forward 5 seconds
CTRL+RIGHT ARROW		Step forward 60 seconds
Dedicated keyboard, replay buttons		
Media Play/Pause button		Toggle Play/Pause video replay
Media Stop button		Pause video replay
Media Previous track button	Go to previous AOI Key-frame (Selected AOI)	
Media Next track button		Go to next AOI Keyframe (Selected AOI)

9 Calculating eye tracking metrics and statistics

The Tobii Studio Statistics tool is used to calculate and display eye and mouse tracking metrics' descriptive statistics. These metrics are calculated based on user defined Areas of Interest (AOIs) and data selection time intervals. The data that results from the analysis is displayed in the form of a table and/or chart.

The Tobii Studio Statistics tool supports the creation of complex tables, such as cross test tables composed of multiple media within a single project, creation and export of multi-metric tables, and cross tabulation using participant-independent variables or responses from questionnaires as filters to group participants. The tool also supports the production of descriptive statistics from AOI groups.

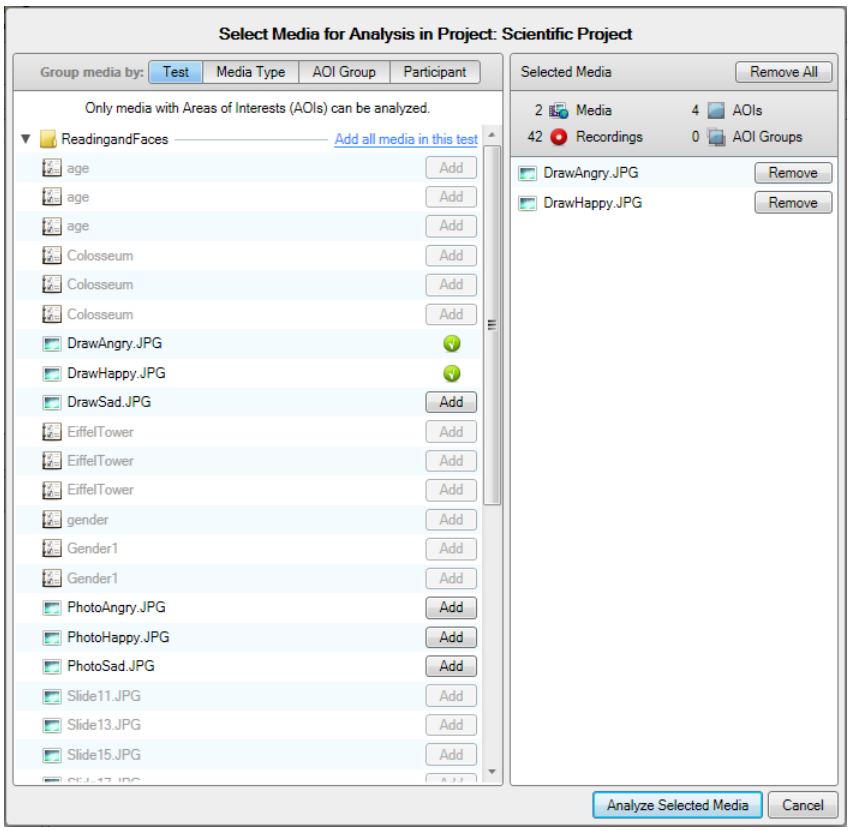


To open the Tobii Studio Statistics tool, click the Statistics tab. The Statistics tab is divided in three main areas:

- Statistics header - Allows you to select media for analysis, copy tables and charts to the clipboard, and export tables and charts.
- Data Selection pane - This is where you can select recordings and chose which AOIs to include in the analysis.
- Statistics workspace - This is where you can select the metrics, create and view tables and charts, and change the statistics settings and properties.

9.1 Choosing media for the analysis

The Select Media for Analysis in Project dialog box allows you to view and select the media for the analysis. Only media with Areas of Interests (AOIs) will be available for analysis. To open the media browser, click the Select Media button on the Statistics header or the Select Media button at the center of the Statistics window.



On the media browser's left list box, you will be able to view a list of all the media included in the current project. The media can be displayed in 4 different views: Test, Media Type, AOI Group and Participant. The Test view displays the media listed in folders by test; Media Type organizes the media by type of media file (e.g. images, videos and scenes); AOI Group displays a list of user-created AOI groups and the media that contains the AOIs that belong to those groups; and Participant displays the media viewed by each project participant. To toggle between the different views, click the Group media by selection buttons.

Important notes on dynamic AOIs and eye tracking metrics:

- Dynamic AOIs can be either **active** or **inactive.** Only **active** AOIs will collect data. This means that if there is a fixation on an AOI that goes from being **inactive** to **active** at some stage during the fixation, only fixation data points from the interval where the AOI was **active** will be collected. The same is true if the AOI goes from **active** to **inactive.** The result of this is that fixations can be "cut off" when the AOI changes activation state (**active/inactive)**. "Cut off" fixations will affect all descriptive statistics relating to time.
- Dynamic AOIs can move along user-defined paths on the media. This means that a dynamic AOI following its path can potentially move to cover an already ongoing fixation. Only the fixation data points from the interval where the active AOI covers the fixation will be collected. The same is true if the AOI moves away from on ongoing fixation. The result of this is that fixations can be "cut off" when the AOI moves. "Cut off" fixations will affect all descriptive statistics relating to time.

To add media to your analysis, click the Add buttons next to the items in the media list or click Add all media ... to add all the media included in the Test, Media Type, AOI Group or Participant views (depending how the media is organized).

When the mouse pointer is placed over an item in the media list, a preview thumbnail of that item is displayed.

When you add a media item to the analysis, it will be displayed in the Selected Media list. A media item can be removed from the list by clicking the Remove button. To clear the Selected Media list, click Remove All. All items selected on the left are displayed in the Select Media list.

When you are finished selecting the media, click the Analyze Selected Media button to close the browser, or Cancel to quit the media browser without selecting a media item.

9.2 Selecting data

The Data Selection pane allows you to select the recordings, AOIs or AOI groups you want to include or exclude from the analysis. For example, you can select a subset of the recordings for analysis by using filters based on participant-independent variables or based on segment groups (for information on segment groups please read *5.4.3 Grouping Segments*). The Data Selection pane is divided into two distinct sections – the Recordings and Areas of Interest list boxes.

9.2.1 Choosing recordings

The Recordings list is located on the Data Selection panel and displays all the recordings associated with the selected media. The list can be used to select the recordings that will be included in the analysis. Each recording is displayed as a row and contains the following information:

- Name: ID of the recording
- Date: Shows the time and date when the recording was performed
- Duration: The duration of the recording in seconds
- Color: The color used to identify the recording on the timeline and in the visualizations on the Visualization tab.
- Samples: The quality of the recording is calculated using the number of eye tracking samples that were correctly identified. 100% means that both eyes were found throughout the recording; 50% that one eye was found for the full recording or both eyes during half the time. Note that the eyes cannot be found when a person is looking away from the screen; this will result in a lower percentage. If the test is performed so that the participant is asked questions during the recording and occasionally looks at a test leader, an alternative method should be considered.
- Participant: The name of the test participant

To show the Samples and Colors columns, right-click the recordings list, select Show Columns and then select the parameter to be displayed. To remove a column from the Recordings list, repeat the process explained above and then clear the check marks for the respective columns.

All the recordings are selected by default (i.e. check boxes are selected). To remove a recording from the analysis, clear the check box in the Recordings list associated with that recording. Click the Check/Uncheck button to toggle selection of all the recordings.

9.2.1.1 Using independent variables and segment groups to filter recordings

Filtering allows you to restrict your data to a group of participants. For example, if you have created an independent variable called gender you can produce two separate heat maps for women and men by creating two filters, one for males and another for females. Each filter can be defined by either one independent variable or a combination of independent variables.

You can view, select, create, and manage filters in the Recordings lists of the Visualization tab.

Use the Participant Group or Segments Group drop-down lists located at the top of the Recordings list of the Selection pane to filter the recordings according to participant groups and/or segment groups.

By default, no filters are applied, meaning that the default selections are:

- All Participants — for the Participant Groups
- Full Recordings — for the Segment Groups

To create a new participant group:

1. Click the Participant Group drop-down list. This opens the Participant Groups list.
2. Click Create new participant group. The New Participant Group dialog box opens.
3. Type a group name in the Participant Group Name field.
4. Click an independent variable in the Variables list and select the values you wish to include in the participant group by selecting the check boxes in the Values list.
5. You can choose to filter by one independent variable or a combination of several independent variables (e.g. the group young Danish women can be created by using the independent variable combination age, nationality, and gender). In order to create a multivariable group, repeat step 4 for other variables you wish to use to describe the group.

6. Click OK to create or Cancel to dismiss the new group.

To select a participant group:

1. Click the Participant Group drop-down list button. This opens the Participant Groups list.
2. Under Participant Groups, select an existing group by clicking the group. The list of recordings will be updated automatically, showing only the recordings that fulfill the group conditions.

To edit an existing participant group:

1. Click the Participant Group drop-down list button. This opens the Participant Groups list.
2. Click the Edit button to the right of the group name in the Participant Groups list. This opens the Edit Group... dialog box.
3. Change the group name in the Participant Group Name field.
4. Click an independent variable in the Variables list and select the values you wish to include or exclude in the group definition by selecting the check boxes in the Values list.
5. Repeat step 4 for other variables you wish to change.
6. Click OK to accept or Cancel to dismiss the changes.

To delete an existing participant group:

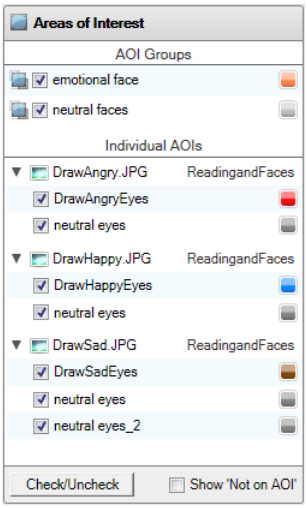
1. Click the Delete button to the right of the group name in the Participant Groups list.
2. Confirm the deletion by clicking Yes in the Delete Filter dialog box. If you wish to cancel the deletion click No.

To select a segment group:

1. Click the Segment Group drop-down list button. This opens the Segment Groups list. (for more details about Segment Groups read *5.4.3 Grouping Segments*)
2. Select an existing group from a list by clicking the group. The list of recordings will be updated automatically, showing only the recordings that fulfill the group conditions.

9.2.2 Selecting Areas of Interest

The Areas of Interest list is located in the data selection panel and displays all the Areas of Interest (AOI) and AOI groups that were drawn on the selected media.



AOI groups are listed first and are separated from individual AOIs by a list divider. Each AOI group row contains the name of the group, a check box where you can toggle selection of the group for analysis, and the color used to display the group in charts. The color of an AOI group can be edited by clicking the color button and selecting a color from the color palette.

AOI groups will only be available for analysis if all the media containing the AOI groups are selected.

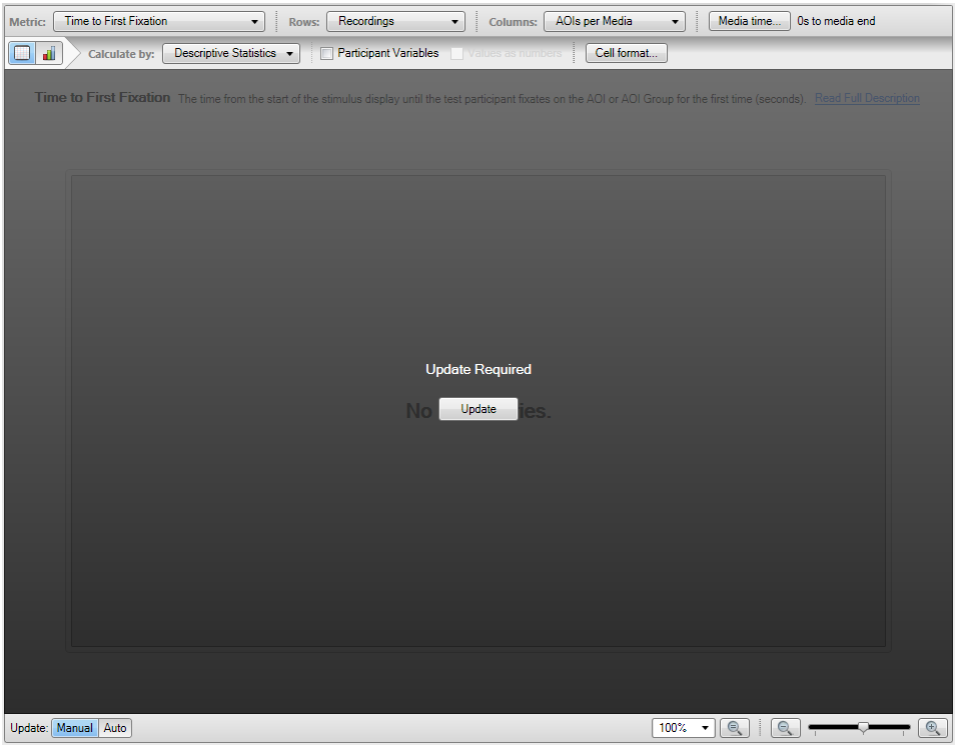
The individual AOIs are displayed per selected media in a two-level collapsible list. The first level contains the media and the test names, and the second level a list of the individual AOIs belonging to that media. Each AOI row contains the AOI name, a check box that you can select or clear for AOI analysis, and the color used to display the AOI in charts. The color of an AOI can be edited by clicking the color button and selecting a color from the color palette.

Click the Check/Uncheck button to toggle selection of all the AOIs. Note that clicking the Check/Uncheck button toggles selection of the individual AOIs and does not influence the AOI groups. Selection of an AOI group is toggled by clicking the check boxes associated with the AOI group.

Select the Show "Not on AOI" check box to include fixation or mouse click data that is not included in any of the AOIs in the analysis. The "not on AOI" data will be displayed per media.

9.3 Building Statistics tables and charts

The Statistics workspace consists of toolbars for defining how the data is presented in the tables and charts. You can select AOI metrics, create and view tables and charts, and change the statistics settings and properties. The results from your AOI analysis are displayed in the central section of the Statistics workspace. This section is called the Statistics Display Area. The analysis output can be a descriptive statistics table or chart and depends on the Statistics or Table and Charts toolbar settings.



By default, when you change a setting on the toolbars or toggle selection of items in the Data Selection panel, the central section of the Statistics workspace will turn dark and you need to click the Update button to recalculate and display the table and or chart. To change the setting to automatically update when a setting has been changed, click Auto, next to Update in the lower-left corner of the Statistics workspace.

9.3.1 Configuring tables and charts

The Statistics toolbar is located at the top of the Statistics workspace and displays several drop-down list boxes. These list boxes allow you to select eye tracking metrics and set general row and column settings related to the organization of the data in the tables and charts. In addition, you can also select which portion (time interval) of the media view time you wish to analyze by selecting a start time and duration value.

The Table and Chart toolbar is located in the top section of the Statistics workspace, just below the Statistics toolbar. Click the Table and Chart buttons on the toolbar to toggle between the Table and Chart views.

Tip: Right-click directly on the table or chart to select different customization commands, as well as to copy and export the table or graph.

9.3.1.1 Metric

The Metric drop-down list contains eye and mouse tracking metrics that can be calculated for each AOI or AOI group. The metric you choose for the analysis will depend on the type of research question you wish to answer. For a detailed description of each metric, read *9.4 Eye tracking metric definitions*.

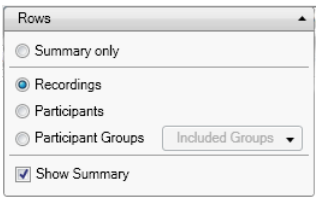
To select one or more metrics:

1. Click the Metric drop-down list.
2. Select a metric by checking/clearing the metric's check box.
3. Click anywhere outside the list to close the list.

Tip: Place the mouse over the metric to view a brief description.

9.3.1.2 Rows

Use the Rows drop-down option box to choose how the rows in the table are displayed, as well as the X-axis of the charts. The rows can be set to Summary only, Recordings, Participants, or Participant Groups.



Row options:

- Summary only: Displays only the row (table) or bar (chart) that contains the values that globally summarize the data from the selected recordings and AOIs.
- Recordings: Each row represents a recording.
- Participants: Each row represents a participant. If the participant has two different recordings the results will be combined into a single row.
- Participant Groups: Each row represents a participant group.

To select the Rows option:

1. Click the Rows drop-down list to view the available options.
2. Select an option by clicking Summary only, Recordings, Participants or Participant Groups.
3. If you select Participant Groups from the list, select a group by checking/clearing the group check boxes, or create a new group by clicking New Participant Group. Read about how to create a new group in the Creating a new participant group section above.
4. Click anywhere outside the list to close it.

When you select Recordings, Participants or Participant Groups, a global summary row or column will be displayed in the table or chart. Clear the Show Summary check box if you wish to hide this row (table) or bar (chart).

9.3.1.3 Columns

The Columns drop-down list allows you to choose how the AOI data is calculated and displayed in table columns and the X-axis of charts

To select the Columns option:

1. Click the Columns button. The Columns list is displayed.
2. Choose a setting by selecting the AOIs per Media, AOI Media Summary, AOI Group Summary or AOI Metric summary check boxes.
3. Click anywhere outside the list box to close it.

Column levels in tables:

AOIs per Media- Each cell contains the descriptive statistic value for a single AOI or a single AOI group. The cell value calculation also depends on the Row option selection. The data is displayed using the following column hierarchal order: metric>media>AOIs and/or AOI Groups>Descriptive Statistics.

Example below: 2 images (DrawAngry.JPG and DrawHappy.JPG), 4 AOIs (DrawAngryEyes, DrawHappyEyes and 2 neutral eyes), Row option Recording

	Time to First Fixation											
	DrawAngry.JPG						DrawHappy.JPG					
	DrawAngryEyes			neutral eyes			DrawHappyEyes			neutral eyes		
Recordings	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)
Rec 01	1	0.58	0.58	1	2.14	2.14	1	0.77	0.77	1	1.19	1.19

AOI Media Summary - Each cell in the AOI Media Summary columns contains the descriptive statistic value for all the AOIs present in a single media element. The cell value calculation also depends on the Row option selection. The data is displayed using the following column hierarchal order: metric>media>All AOIs (groups the data from all AOIs present in each media)> Descriptive Statistics.

Example below: 2 images (DrawAngry.JPG and DrawHappy.JPG), 2 AOIs (DrawAngryEyes and neutral eyes), Row option Recordings

	Time to First Fixation					
	DrawAngry.JPG			DrawHappy.JPG		
	All AOIs			All AOIs		
Recordings	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)
Rec 01	2	1.36	2.72	2	0.98	1.96

AOI Group Summary - Each cell in the AOI Group Summary columns contains the descriptive statistic value for an AOI group calculated for all the selected media. The cell value calculation also depends on the Row option selection. The data is displayed using the following column hierarchal order: metric>All media (groups the data from all the selected media)>AOI Group > Descriptive Statistics.

Example below: 2 images (DrawAngry.JPG and DrawHappy.JPG), 2 AOI Groups (emotional face and neutral faces), Row option Recordings

	Time to First Fixation					
	All Medias					
	emotional face			neutral faces		
Recordings	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)
Rec 01	1	0.85	0.85	1	0.30	0.30

AOI Metric Summary - Each cell in the AOI Metric Summary columns contains the descriptive statistic value for all AOIs and all the media. The cell value calculation also depends on the Row option selection. The data is displayed using the following column hierarchal order: metric>All media (groups the data from all the selected media)>All AOIs (groups the data from all AOIs present in each media)> Descriptive Statistics.

Example below: 2 metrics (Time to First Fixation and Fixation Duration), 2 images (DrawAngry.JPG and DrawHappy.JPG), 2 AOIs (DrawAngryEyes and neutral eyes), Row option Recordings

	Time to First Fixation			Fixation Duration		
	All Medias			All Medias		
	All AOIs			All AOIs		
Recordings	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)
Rec 01	4	1.17	4.68	6	0.44	2.64

X-axis levels in charts:

- **AOIs per media**: Each bar represents the data from an AOI belonging to a single media element. The bars are organized by media, Row option selection, and then AOI.
- **AOI Media Summary**: Each bar represents the data from all AOIs present in a single media element. The bars are organized by media and then Row option selection.
- **AOI Group Summary**: Each bar represents the data from an AOI group calculated for all the selected media. The bars are organized by Row option selection and then AOI group.
- **AOI Metric Summary**: Each column represents the data from all AOIs and all media. The bars are organized by Row option selection.

9.3.1.4 Selecting a time interval for analysis

Use the Media time... button in the Statistics workspace to restrict the analysis to a specific time interval of your recording. This is done by first selecting the start time of the interval and then by defining the duration of the interval. These settings will be applied to all recordings included in the analysis. The currently selected start time and duration are displayed to the right of the Media time... button.

To set the start time and duration for data collection:

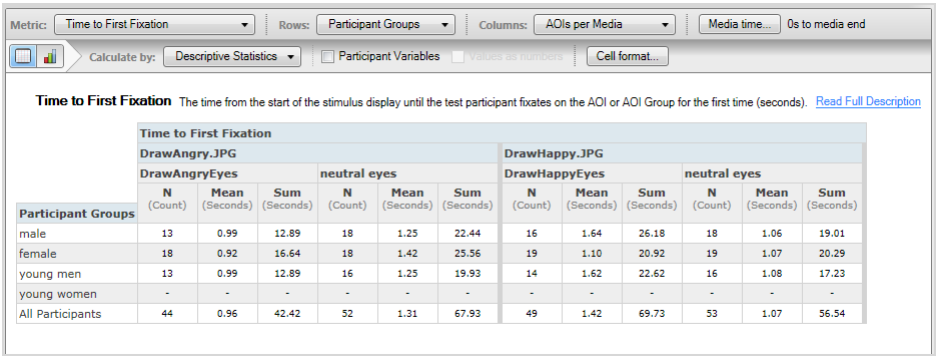
1. Click the Media time... button. The Media Time dialog box opens.
2. Set the start time in seconds in the Start Time: field.
3. If you wish to specify the duration of the data collection, select the second option and specify the duration in seconds in the field. Otherwise, select the Until media end option.
4. Confirm your selections by clicking Done.

If the start or end time of your selection is located in the middle of a fixation, that fixation will be entirely removed from the metrics calculations.

When the Media time... data selection is applied the metrics, Time to First Fixation, Time to First Mouse Click and Time to First Mouse Click Across, are calculated from the start of the media display. While other metrics, such as Fixation Duration or Visit Duration, are calculated within the selected interval only.

9.3.1.5 Table options

Tables display the AOI analyses organized by column headings, such as metrics, media, AOI and descriptive statistics, and by row headings, such as recordings, participants or participant groups. Tables can easily be exported to TXT files or copied to the clipboard and pasted into a document.


Metric: Time to First Fixation
Rows: Participant Groups
Columns: AOIs per Media
Media time...
0s to media end
Calculate by: Descriptive Statistics
Participant Variables
Cell format...
Time to First Fixation The time from the start of the stimulus display until the test participant fixates on the AOI or AOI Group for the first time (seconds). Read Full Description

	Time to First Fixation											
	DrawAngry.JPG						DrawHappy.JPG					
	DrawAngryEyes			neutral eyes			DrawHappyEyes			neutral eyes		
Participant Groups	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)	N (Count)	Mean (Seconds)	Sum (Seconds)
male	13	0.99	12.89	18	1.25	22.44	16	1.64	26.18	18	1.06	19.01
female	18	0.92	16.64	18	1.42	25.56	19	1.10	20.92	19	1.07	20.29
young men	13	0.99	12.89	16	1.25	19.93	14	1.62	22.62	16	1.08	17.23
young women	-	-	-	-	-	-	-	-	-	-	-	-
All Participants	44	0.96	42.42	52	1.31	67.93	49	1.42	69.73	53	1.07	56.54

The Table columns headings are composed of 4 rows that follow a specific hierarchical order. The first row displays the metrics columns, the second row shows the media columns, the third row displays the different AOI and/or AOI groups columns and the fourth row shows the descriptive statistics columns.

The row's title is displayed in the first column of the table. The heading and content of this column changes according to the settings in the Row list box in the Statistics toolbar. The last row of data in the table displays a summary of the data from all the table rows.

Above the table you can view a brief description of the metrics selected to generate the tables.

The Table properties are available when you click the Table button. In the toolbar, located at the top of the Statistics workspace, you can customize which descriptive statistics you want to display in the table, the option to show participant variables and the table cell format.

To select the descriptive statistics:

1. Click the Calculated by: button. The Descriptive Statistics list is displayed.
2. Select descriptive statistics to include in the table by selecting the N, Mean, Max, Min, Sum, Median or Stdev check boxes. Click anywhere outside the list box to close it.

To include participant variables:

1. Select the Participant Variables check box. This adds the participant variables to the table.
2. To select to display the participant variables as numbers instead of text, select the Values as Numbers check box.

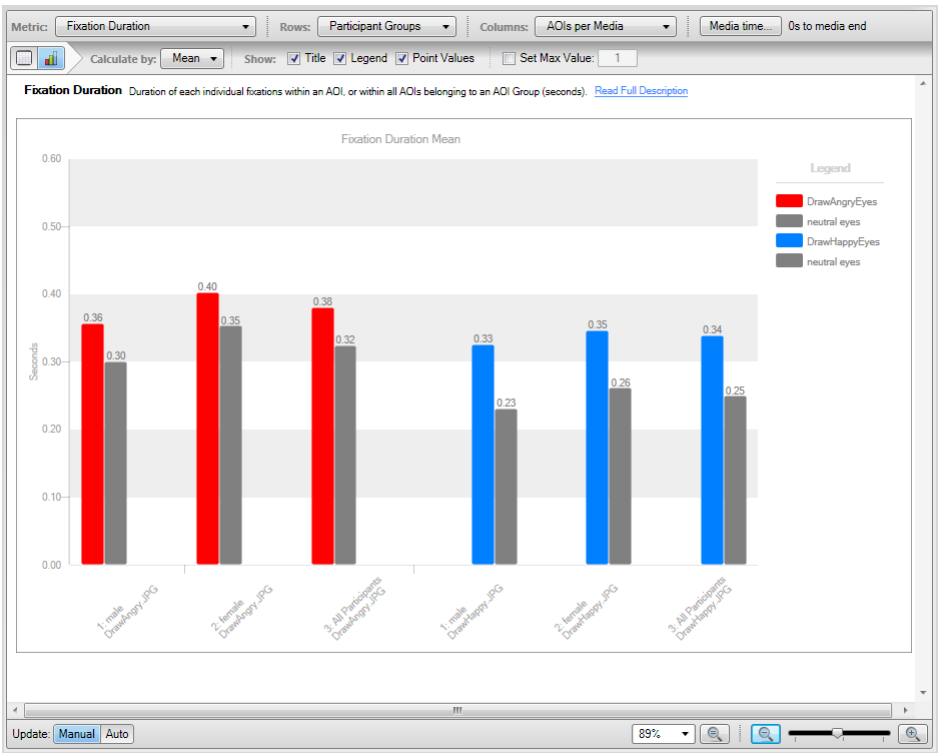
When the option Values as Numbers is selected for the participant variables, a table containing the numerical translation between the values and the numbers will be displayed above the table containing the data.

To change the cell format:

1. Click the Cell format... button. The Cell Format dialog box is displayed.
2. Set the number of decimals to be displayed by typing a number in the Number of Decimals: field.
3. Set the decimal separator, type the appropriate character in the Decimal Point: field.
4. Set what to display if no value is available by typing the appropriate character in the No value: field.
5. To specify how percentage values should be displayed, click the Percentage drop-down list button. The available options in the drop-down list are Percentages and Decimals. Click Done when finished.

9.3.1.6 Chart options

Displays the AOI analyses in a chart. Charts can be easily created and exported as image files or copied to the clipboard and pasted into a document.



The chart generated by the Statistics tool is a predefined bar chart, where the height of each bar indicates the descriptive statistic value for a pre-chosen metric (e.g. mean fixation duration or maximum fixation duration). This value can be displayed on top of each bar by selecting display of Point Values.

Each bar in a chart represents an AOI, AOI group, or AOI summary (all AOIs). The categories on the X-axis are determined by the row settings in the Statistics toolbar.

The Y-axis variable is determined by the metric setting. For example, when Fixation Duration is selected the unit will be in seconds, while with Fixation Count it will be in counts.

The title of the chart is centered just below the upper border of the chart and displays the name of the metric and descriptive statistic used to generate the chart. The chart legend is displayed on the right side of the chart area and shows the color code of the bars in the chart and the respective AOI, AOI group, or AOI summary (all AOIs) names.

When you select participant groups, the chart will also display summary bars (all participants). This bar is calculated using the data from all the recordings included in all the participant groups.

When you select multiple metrics, each metric will be displayed in its own chart. Use the scroll bar to view the different charts.

Above the chart area you can view a brief description of the metrics used to generate the charts.

The chart properties are available when you click the Chart button. On the toolbar, you can select the descriptive statistic and customize the information displayed on the graph, such as showing the title, legend, point values and setting a maximum value for the Y-axis.

To select the descriptive statistic:

1. Click the Calculate by: button. The Descriptive Statistics drop-down list is displayed. The selected value is displayed by default as the header of the list.
2. Select the descriptive statistics by clicking the Mean, Max, Min, Sum or Stdev option buttons.
3. Click anywhere outside the list to close it.

You can choose not to show the title, legend and/or point values by clearing the respective check boxes.

Select the Set Max Value check box and type an integer value in the Set Max Value field to change the maximum value of the Y-axis scale.

9.3.2 Update and zoom options

The bottom part of the Statistics workspace contains the Update and Zoom toolbar where you can change the zoom settings, as well as toggle between automatic or manual updates of the tables and charts display.

9.3.2.1 Update settings

The Manual and Auto buttons control the behavior of the chart and table updates when you change a setting in the toolbars or toggle selection of items on the Data Selection panel. If Manual is selected, the user has to click the Update button before any changes are shown in the table or charts. This allows the user to make all selections before any calculations are made, which can speed up the selection process. If the Auto button is clicked, all changes in settings and selections will take immediate effect and the tables or charts recalculation process triggered.

9.3.2.2 Zoom settings

The zoom controls of the table and chart display are located in the section to the right of the Update and Zoom toolbar. The first set of controls is a drop-down list with some commonly used preset zoom values and a button to reset the zoom level to 100%. The second set of controls is composed of two buttons (Zoom-out and Zoom-in) and a zoom slider. Move the slider to the left to zoom out in the display or click the Zoom-out button (-). To zoom in, move the slider to the right or click the Zoom-in button (+).

9.4 Eye tracking metric definitions

The main eye movement measurements used in Tobii Studio are based on two basic events fixations and mouse clicks. In order to calculate the eye movement metrics, you first have to define Areas of Interest (AOIs) in your media. The different metrics are then calculated in relation to these AOIs, e.g. Fixation Count on AOI A will be calculated as the number of fixations located inside the AOI A.

The calculation of the metrics based on fixations is affected by the fixation filters settings. By changing the settings or the type of the fixation filter, you change the way a single fixation is defined (i.e. how many individual gaze points a fixation will be composed of) and as a consequence, both count and duration values change.

9.4.1 Descriptive statistics

Descriptive statistics are used to present the data values calculated by each eye tracking metric. The meaning and value of the descriptive statistics vary with the column, row, and metric options. Refer to the metrics descriptions in the following sections to interpret the descriptive statistics values.

Descriptive Statistic	Definition
N	Number of data values or sample size used to calculate the Mean and Stdev (number of recordings, fixations, visits or participants).
Mean	Describes the central tendency of a set of data values. It is calculated by summing all the data values and dividing by N (number of data values). Tobii Studio calculates the arithmetic mean.
Max	Highest value in the data set.
Min	Lowest value in the data set.
Sum	The sum of all data values.
Median	The value that separates a data set in two halves. The value is calculated by first arranging a finite list of data values from lowest to highest value and then determining which data value is located at the middle of the list – the median value. If the number of data values is even, then there is no single middle data value, The median is then defined by the average of the two data values.
Stdev (Standard Deviation)	Describes the variability in a set of data values. The value is calculated by square rooting the average of the squares of the deviations of each data value from the mean. Tobii Studio calculates the sample standard deviation (N-1).

9.4.2 Time to First Fixation - seconds

This metric measures how long it takes before a test participant fixates on an active AOI or AOI group for the first time. The time measurement starts when the media containing the AOI is first displayed. For AOI groups, the time measurement starts when any of the media containing an AOI member of the group is first displayed. The AOIs do not have to be active for the time measurement to start. Time measurement stops when the participant fixates on the AOI if the AOI is active. For AOI groups, the time measurement stops when the participant fixates on any of the active AOIs belonging to the group.

If during the recording the same media is displayed several times, with other media in between, the Time to First Fixation value will be calculated by adding each recorded media time of the media containing the AOI until the participant fixates on the active AOI. Recording time of media not containing the AOI is excluded from the calculations.

The activation state, active/inactive, of the AOI does not affect the counting starting point. Even if the AOI is inactive time will be started and measured.

If at the end of the recording the participant has not fixated on the AOI, the Time to First Fixation value will not be computed and that recording will thus not be included in the descriptive statistics calculations (e.g. when computing the N value).

When browsing a website or PDF document, each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.

9.4.2.1 N value

This statistic describes the N value used to calculate other descriptive statistics such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

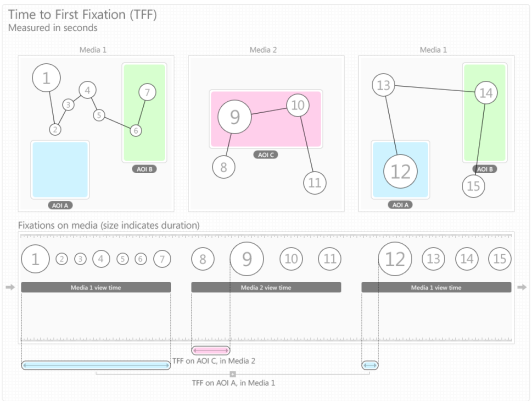
If participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).



9.4.2.2 Brief description

The time from the start of the media display until the test participant fixates on the AOI or AOI group for the first time (seconds).

9.4.2.3 Aligning the metric starting time with the AOIs' active starting point in time

To start counting at the same time an AOI becomes active:

1. In the Areas of Interest tab, move the Time indicator slider to the key frame where the AOI becomes active.
2. Note the current time, displayed above the video controls.
3. In the Statistics tab, on the toolbar, click the Media time... button, the Media Time dialog opens.
4. In the Media Time dialog, enter the AOIs' start time you just noted and click Done.

Changing the data collection Starting Time will affect all metrics in the table.

9.4.3 Time to First Fixation (Across media)

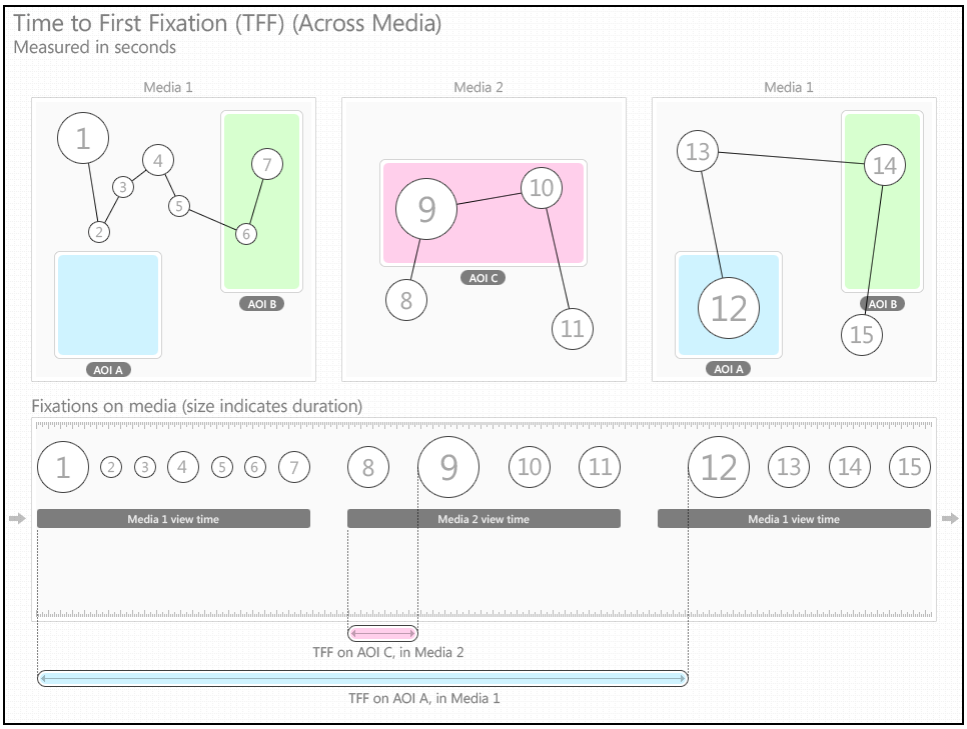
This metric measures how long it takes before a test participant fixates on an active AOI or AOI group for the first time. The time measurement starts when the media containing the AOI is first displayed. For AOI groups, the time measurement starts when a media containing an AOI member of the group is first displayed. The AOIs do not have to be active for the time measurement to start. Time measurement stops when the participant fixates on the AOI if the AOI is active. For AOI groups, the time measurement stops when the participant fixates on any of the active AOIs belonging to the group.

If during the recording, media containing the same AOI is displayed several times, with media not containing the AOI in-between, Time to First Fixation (Across media) will be the sum of all recorded media time until the participant fixated on the AOI (while the AOI is **Active**). **Recording time for media not containing the AOI is included in the calculations**.

If the participant has not fixated on the AOI at the end of the recording, the Time to First Fixation value will not be computed and that recording will therefore not be included in the descriptive statistics calculations (e.g. when computing the N value).

When browsing a website or PDF document, each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.



9.4.3.1 N value

This statistic describes the N value used to calculate other descriptive statistics such as the mean and standard deviation. In the current metric it represents the number of recordings and is calculated as follows:

Row settings:

When recordings are selected as table rows the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

When participant groups are selected as rows, the N value will be equal to the number of recordings included in the group.

Summary columns:

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).

9.4.3.2 Brief description

The time from the start of the media display until the test participant fixates on the AOI or AOI group for the first time (seconds).

9.4.3.3 Aligning the metric starting time with the AOIs' active starting point in time

To start counting at the same time an AOI becomes active:

9.4.4 Fixations Before - count

This metric measures the number of times the participant fixates on the media before fixating on an AOI or AOI group for the first time. The fixation count starts when the media containing the AOI is first displayed and it stops when the participant fixates on the AOI. When using AOI groups, the fixation count stops when the participant fixates on any of the AOIs belonging to the group.

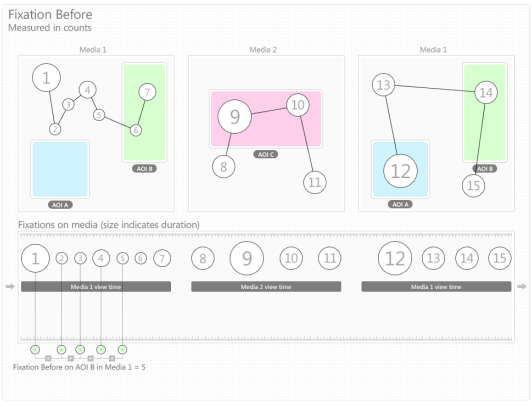
If during the recording, the same media is displayed several times, with other media in between, only the fixations on the media containing the AOI are counted (fixations on the other media are excluded from the calculations).

The activation state, **active/inactive,** of the AOI does not affect the counting starting point. Even if the AOI is **inactive** counting will be started.

If at the end of the recording the participant has not fixated on the AOI, the Fixation Before value will not be computed and that recording will thus not be included in the descriptive statistics calculations (e.g. when computing N).

When browsing a website or PDF document each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.



9.4.4.1 N value

This statistic describes the N value used to calculate other descriptive statistics such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

If participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of Recordings x the total number of AOIs (i.e. all AOIs included in all media elements).

9.4.4.2 Brief description

Number of times the participant fixates on the media before fixating on an AOI or AOI group for the first time (count).

9.4.4.3 Aligning the metric starting time with the AOIs' active starting point in time

To start counting at the same time an AOI becomes active:

1. In the Areas of Interest tab, move the Time indicator slider to the key frame where the AOI becomes active.
2. Note the current time, displayed above the video controls.
3. In the **Statistics** tab, on the toolbar, click the **Media time...** button, the Media Time dialog opens.

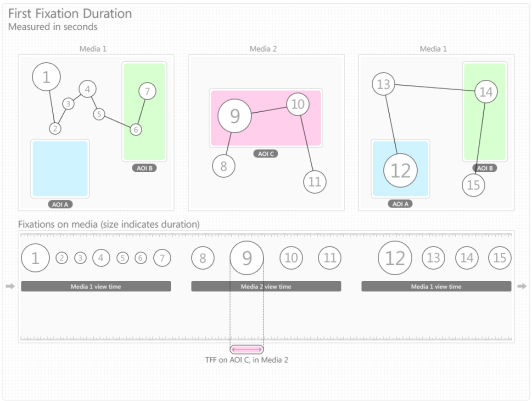
In the Media Time dialog, enter the AOIs' start time you just noted and click **Done**. WARNING: Changing the data collection Starting Time will affect all metrics in the table.

9.4.5 First Fixation Duration - seconds

This metric measures the duration of the first fixation on an AOI or an AOI group. When using AOI groups, the measured fixation corresponds to the first fixation on any of the AOIs belonging to the group.

"Cut off" fixations as described in the introduction of section 0, will affect descriptive statistics for this metric. There are no limitations on how short these "cut off" fixations can be to still be included in the calculations of a metric.

If at the end of the recording, the participant has not fixated on the AOI, the First Fixation Duration value will not be computed and that participant will thus not be included in the descriptive statistics calculations (e.g. when computing N).



9.4.5.1 N value

This statistic describes the N value used to calculate other descriptive statistics such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

If participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).

9.4.5.2 Brief description

Duration of the first fixation on an AOI or an AOI group (seconds).

9.4.6 Fixation Duration - seconds

This metric was previously called Fixation Length in older versions of Tobii Studio and measures the duration of each individual fixation within an AOI (or within all AOIs belonging to an AOI group). The N value used to calculate the descriptive statistics, such as mean and standard deviation, is based on the number of fixations (read the N value description below for more details).

If during the recording, the participant returns to the same media element, the new fixations on the media will also be included in the calculations of the metric.

If at the end of the recording, the participant has not fixated on the AOI, the Fixation Duration value will not be computed and that recording will thus not be included in the descriptive statistics calculations (e.g. when computing averages for participant groups).

9.4.6.1 N value

This statistic describes the N value used to calculate other descriptive statistics such as the mean and standard deviation. In the current metric, it represents the number of fixations and is calculated as follows:

Row settings

When recordings are selected as table rows, N is equal to the total number of fixations on an AOI.

If participants are selected as table rows, N is equal to the total number of fixations a participant has made on the AOI. If the participant has made more than 1 recording with the same media element, N will be equal to the sum of the number of fixations from all the recordings.

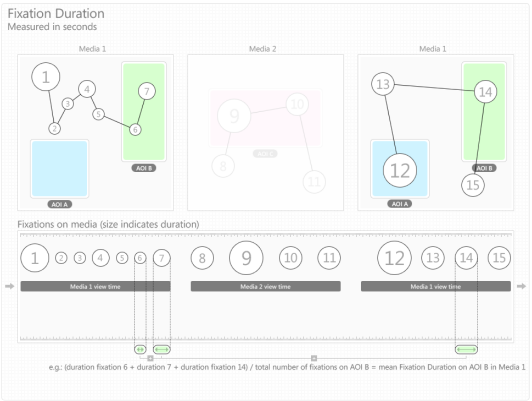
If participant groups are selected as rows, then N will be equal to the sum of the number of fixations of all the recordings included in the group.

Summary columns

In the AOI media summary column, the N value represents the total number of fixations on all AOIs included in a single media element.

In the AOI group summary column, the N value represents the sum of the fixations on all the AOIs belonging to the same AOI group and follows the rules described in the previous paragraph for recordings, participants and participant groups.

In the AOI metric summary column, the N value represents the total number of fixations on all AOIs included in all media elements.



9.4.6.2 Brief description

Duration of each individual fixation within an AOI, or within all AOIs belonging to an AOI group (seconds).

9.4.7 Total Fixation Duration - seconds

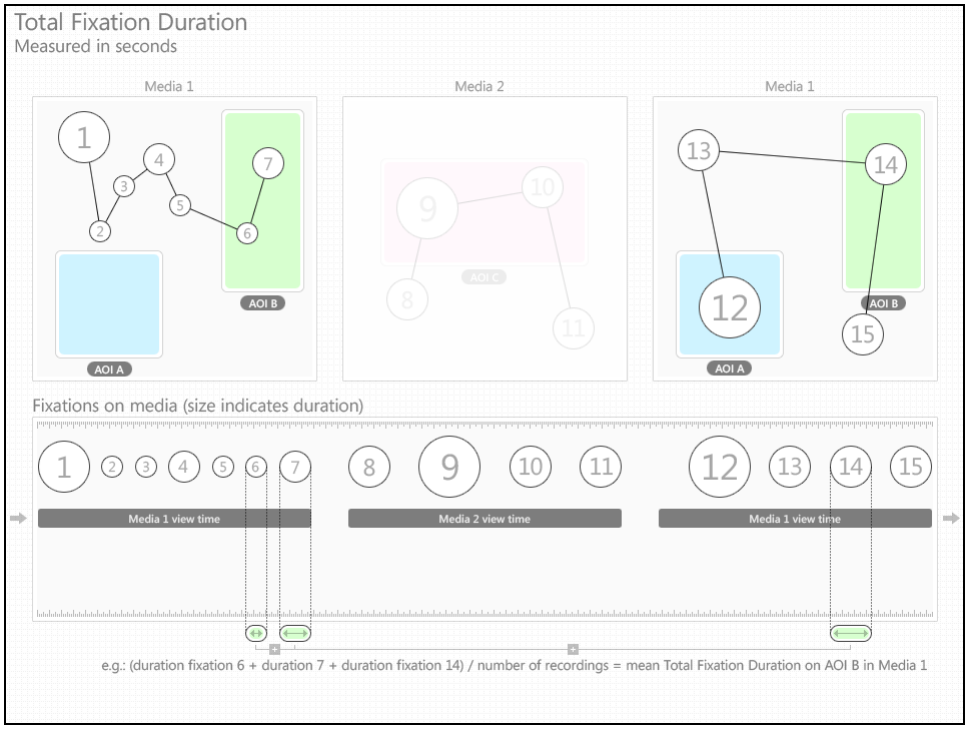
This metric measures the sum of the duration for all fixations within an AOI (or within all AOIs belonging to an AOI group), thus the N value used to calculate descriptive statistics is based on the number of recordings (read the N value description below for more details).

"Cut off" fixations as described in the introduction of section 0 will affect descriptive statistics for this metric. There are no limitations on how short these "cut off" fixations can be to still be included in the calculations of a metric.

If at the end of the recording, the participant has not fixated on the AOI, the Total Fixation Duration will not be computed and the recording will not be included in the descriptive statistics calculations (e.g. when computing N and means).

When browsing a website or PDF document, each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.


Total Fixation Duration
Measured in seconds
Media 1
Media 2
Media 1
AOI A
AOI B
AOI C
Fixations on media (size indicates duration)
Media 1 view time
Media 2 view time
Media 1 view time
e.g.: (duration fixation 6 + duration 7 + duration fixation 14) / number of recordings = mean Total Fixation Duration on AOI B in Media 1

9.4.7.1 N value

This statistic describes the N value used to calculate other descriptive statistics such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

If participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x total number of AOIs (i.e. all AOIs included in all media elements).

9.4.7.2 Brief description

Duration of all fixations within an AOI, or within all AOIs belonging to an AOI group (seconds).

9.4.8 Total Fixation Duration (zeros) - seconds

This metric is calculated in the same way as Total Fixation Duration with the exception that if at the end of the recording the participant has not fixated on the AOI, the Total Fixation Duration will be registered as zero and the recording will be included in the descriptive statistics calculations (e.g. when computing N and means).

9.4.8.1 Brief description

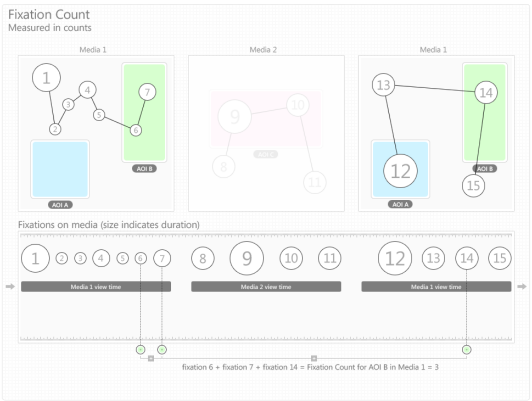
Duration of all fixations within an AOI, or within all AOIs belonging to an AOI group (seconds).

9.4.9 Fixation Count - count

This metric measures the number of times the participant fixates on an AOI or an AOI group.

If during the recording the participant leaves and returns to the same media element, then the new fixations on the media will be included in the calculations of the metric.

If at the end of the recording the participant has not fixated on the AOI, the Fixation Count value will not be computed and the recording will not be included in the descriptive statistics calculations (e.g. when computing N).


Fixation Count
Measured in counts
Media 1
Media 2
Media 1
AOI A
AOI B
Fixations on media (size indicates duration)
Media 1 view time
Media 2 view time
Media 1 view time
fixation 6 + fixation 7 + fixation 14 = Fixation Count for AOI B in Media 1 = 3

9.4.9.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

If participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x total number of AOIs (i.e. all AOIs included in all media elements).

9.4.9.2 Brief description

Number of times the participant fixates on an AOI or an AOI group (count).

9.4.10 Fixation Count (zeros) - count

This metric is calculated in the same way as Fixation Count with the exception that if at the end of the recording the participant has not fixated on the AOI, the Fixation Count value will be registered as zero and the recording will be included in the descriptive statistics calculations (e.g. when computing N and means).

9.4.10.1 Brief description

Number of times the participant fixates on an AOI or an AOI group (count).

9.4.11 Visit Duration - seconds

This metric measures the duration of each individual visit within an AOI (or AOI group). The N value used to calculate descriptive statistics is based on the number of visits (read the N value description below for more details). A visit is defined as the interval of time between the first fixation on the AOI and the next fixation outside the AOI.

"Cut off" fixations as described in the introduction of section 0 will affect descriptive statistics for this metric. There are no limitations on how short these "cut off" fixations can be to still be included in the calculations of a metric.

If at the end of the recording the participant has not fixated on the AOI, the Visit Duration value will not be computed and thus that recording will not be included in the descriptive statistics calculations (e.g. when computing averages for participant groups).

9.4.11.1 N value

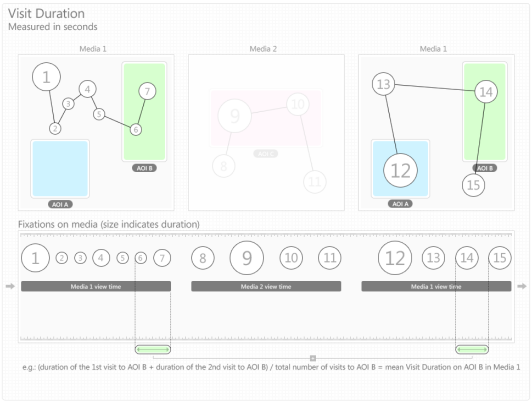
This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric, it represents the number of visits and is calculated as follows:

Row settings

When recordings are selected as table rows, N is equal to the total number of visits to an AOI.

If participants are selected as table rows, N is equal to the total number of visits a participant has made to the AOI. If the participant has made more than 1 recording with the same media element, N will be equal to the sum of the number of visits in all the recordings.

If participant groups are selected as rows, then N will be equal to the sum of the number of visits of all the participants included in the group.



Summary columns

In the AOI media summary column, the N value represents the total number of visits to all AOIs included in a single media element.

In the AOI group summary column, the N value represents the sum of the visits to all the AOIs belonging to the same AOI group and follows the rules described in the previous paragraph for recordings, participants and participant groups.

In the AOI metric summary column, the N value represents the total number of visits to all AOIs included in all media elements.

9.4.11.2 Brief description

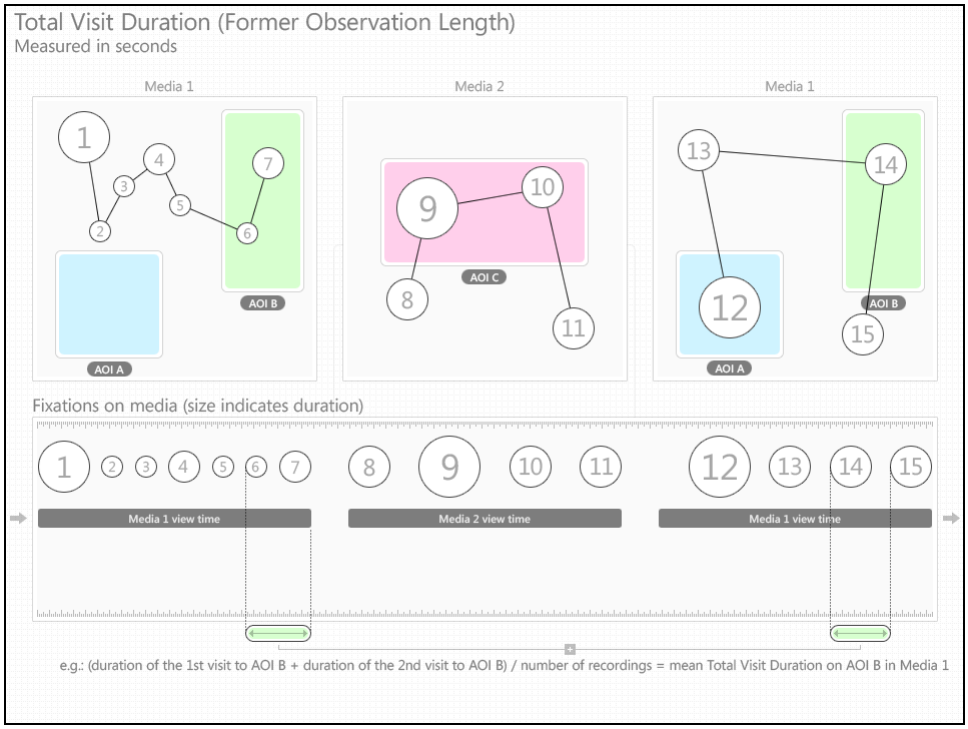
Duration of each individual visit within an AOI or an AOI group (seconds).

9.4.12 Total Visit Duration - seconds

This metric measures the duration of all visits within an active AOI (or AOI group). In this case the N value used to calculate descriptive statistics is based on the number of recordings (read the N value description below for more details). Total Visit Duration is defined as the sum of visit durations of an active AOI (or AOI group). An individual visit is defined as the time interval between the first fixation on the active AOI and the end of the last fixation within the same active AOI where there have been no fixations outside the AOI. For AOI groups, an individual visit is defined as the time interval between the first fixation on any active AOI belonging to the group and the end of the last fixation within on any active AOI within the AOI group, where there have been no fixations outside the active AOIs of the AOI group.

Note: "Cut off" fixations as described in the introduction of section 0 will affect descriptive statistics for this metric. There are no limitations on how short these "cut off" fixations can be to still be included in the calculations of a metric.

If at the end of the recording the participant has not fixated on the AOI, the Total Visit Duration value will not be computed and the recording will not be included in the descriptive statistics calculations (e.g. when computing N).


Total Visit Duration (Former Observation Length)
Measured in seconds
Media 1
Media 2
Media 1
AOI A
AOI B
AOI C
AOI A
AOI B
Fixations on media (size indicates duration)
Media 1 view time
Media 2 view time
Media 1 view time
e.g.: (duration of the 1st visit to AOI B + duration of the 2nd visit to AOI B) / number of recordings = mean Total Visit Duration on AOI B in Media 1

9.4.12.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

If participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).

9.4.12.2 Brief description

Duration of all visits within an AOI or an AOI group (seconds).

9.4.13 Total Visit Duration (zeros) - seconds

This metric is calculated in the same way as Total Visit Duration with the exception that if at the end of the recording the participant has not fixated on the AOI, the Total Visit Duration value will be registered as zero and the recording will be included in the descriptive statistics calculations (e.g. when computing N and means).

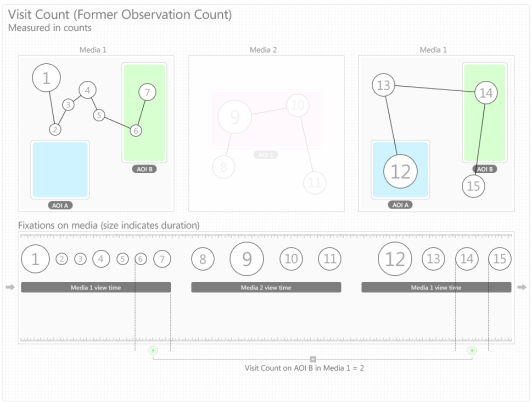
9.4.13.1 Brief description

Duration of all visits within an AOI or an AOI group (seconds).

9.4.14 Visit Count - count

This metric measures the number of visits within an active AOI (or AOI group). A visit is defined as the time interval between the first fixation on the active AOI and the end of the last fixation within the same active AOI where there have been no fixations outside the AOI. For AOI groups, a visit is defined as the time interval between the first fixation on any active AOI belonging to the group and the end of the last fixation within on any active AOI within the AOI group, where there have been no fixations outside the active AOIs of the AOI group.

If at the end of the recording the participant has not fixated on the AOI, the Visit Count value will not be computed and the recording will not be included in the descriptive statistics calculations (e.g. when computing N).



9.4.14.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).

9.4.14.2 Brief description

Number of visits within an AOI or an AOI group (count).

9.4.15 Visit Count (zero) - count

This metric is calculated in the same way as Visit Count with the exception that if at the end of the recording the participant has not fixated on the AOI, the Visit Count value will be registered as zero and the recording will be included in the descriptive statistics calculations (e.g. when computing N and means).

9.4.15.1 Brief description

Number of visits within an AOI or an AOI group (count).

9.4.16 Percentage Fixated — %

This metric measures the number of recordings in which participants have fixated at least once within an AOI or AOI group and expresses it as a fraction of the total number of recordings. It is calculated by dividing the total number of recordings in which participants have fixated within the AOI by the total number of recordings in the test.

9.4.16.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric, it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

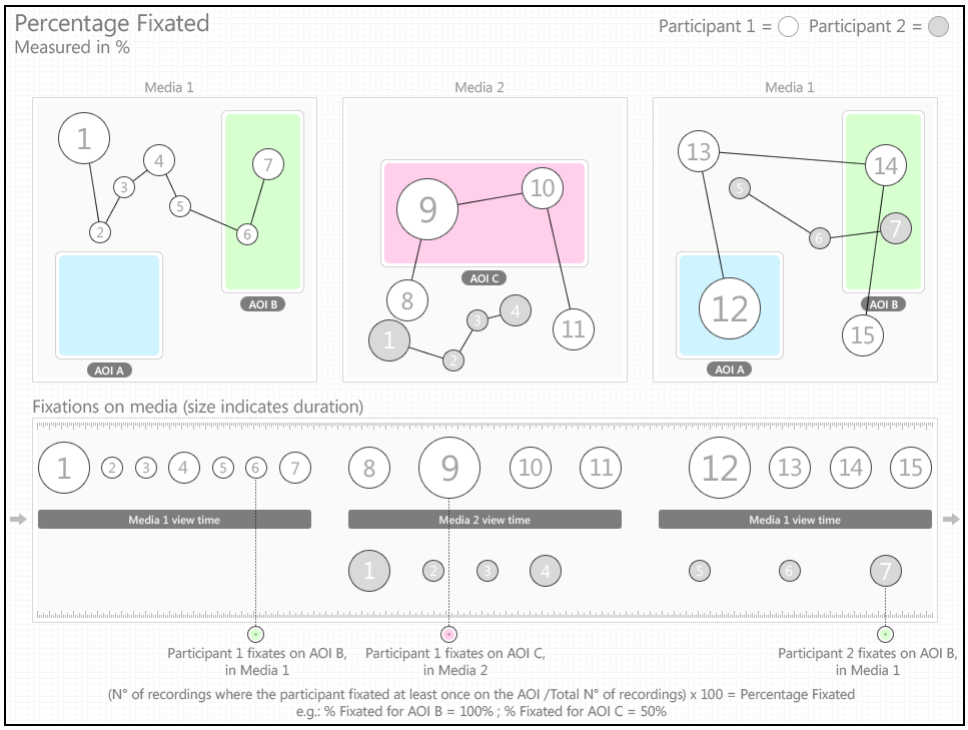
When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).


Percentage Fixated
Measured in %
Participant 1 =
Participant 2 =
Media 1
Media 2
Media 1
AOI A
AOI B
AOI C
AOI B
AOI A
Fixations on media (size indicates duration)
Media 1 view time
Media 2 view time
Media 1 view time
Participant 1 fixates on AOI B, in Media 1
Participant 1 fixates on AOI C, in Media 2
Participant 2 fixates on AOI B, in Media 1
(N° of recordings where the participant fixated at least once on the AOI /Total N° of recordings) x 100 = Percentage Fixated
e.g.: % Fixated for AOI B = 100% ; % Fixated for AOI C = 50%

9.4.16.2 Brief description

Percentage of recordings in which participants fixated at least once within an AOI or AOI group (%).

9.4.17 Percentage Clicked - %

This metric measures the number of recordings where participants have clicked at least once within an AOI or AOI Group. It is calculated by dividing the total number of recordings where participants have clicked within the AOI by the Total number of recordings in test.

9.4.17.1 N value

This statistic describes the N value used to calculate other descriptive statistics such as the mean and standard deviation. In the current metric it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

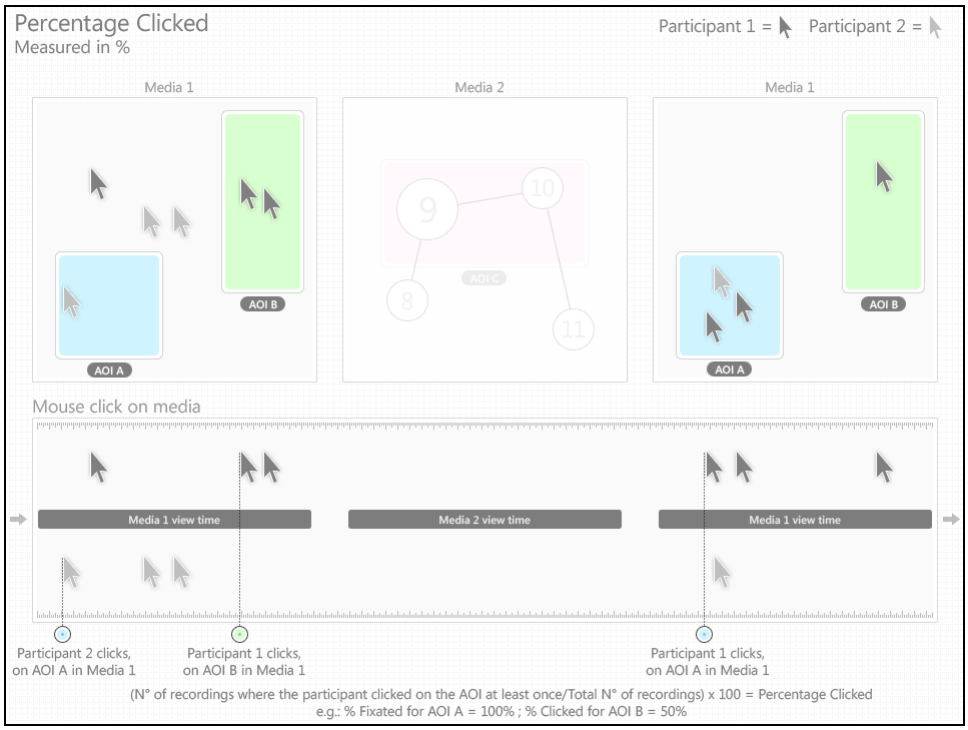
When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).


Percentage Clicked
Measured in %
Participant 1 =
Participant 2 =
Media 1
Media 2
Media 1
AOI B
AOI A
AOI C
AOI B
AOI A
Mouse click on media
Media 1 view time
Media 2 view time
Media 1 view time
Participant 2 clicks, on AOI A in Media 1
Participant 1 clicks, on AOI B in Media 1
Participant 1 clicks, on AOI A in Media 1
(N° of recordings where the participant clicked on the AOI at least once/Total N° of recordings) x 100 = Percentage Clicked
e.g.: % Fixated for AOI A = 100% ; % Clicked for AOI B = 50%

9.4.17.2 Brief description

Percentage of recordings in which participants clicked at least once within an AOI or AOI group (%).

9.4.18 Mouse Click Count - count

This metric measures the number of times the participant left-clicks with the mouse on an AOI or an AOI group.

If at the end of the recording the participant has not clicked on the AOI, the Mouse Click Count value will not be computed and the recording will not be included in the descriptive statistics calculations (e.g. when computing N).

9.4.18.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

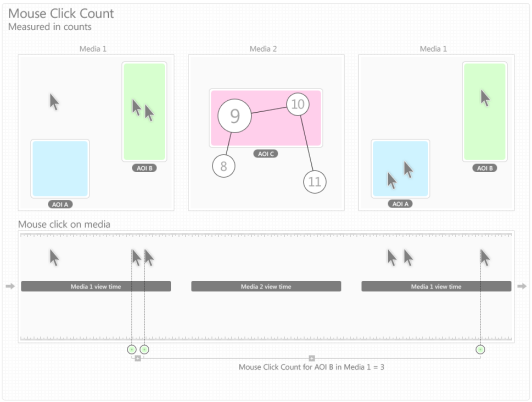
When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).



9.4.18.2 Brief description:

Number of times the participant left-clicks with the mouse on an AOI or an AOI group (count).

9.4.19 Mouse Click Count (zero) - count

This metric is calculated in the same way as Mouse Click Count with the exception that if at the end of the recording the participant has not clicked on the AOI, the Mouse Click Count value will be registered as zero, and the recording will be included in the descriptive statistics calculations (e.g. when computing N and means).

9.4.19.1 Brief description:

Number of times the participant left-clicks with the mouse on an AOI or an AOI group (count).

9.4.20 Time to First Mouse Click - seconds

This metric measures how long it takes before a test participant left-clicks with the mouse on an AOI or AOI group for the first time. The time measurement starts when the media containing the AOI is first displayed and it stops when the participant clicks on the same AOI. When using AOI groups, the time measurement stops when the participant clicks on any of the AOIs belonging to the group.

If during the recording the same media is displayed several times, with other media in between, the reported time will be the sum of the each time the media containing the AOI was viewed until the participant clicks on the AOI (the other media view times are excluded from the calculations).

The activation state, **active/inactive,** of the AOI does not affect the counting starting point. Even if the AOI is **inactive,** time will be started and measured.

If at the end of the recording the participant has not clicked on the AOI, the Time to First Mouse Click value will not be computed and that recording will thus not be included in the descriptive statistics calculations (e.g. when computing N).

When browsing a website or PDF document, each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.

9.4.20.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

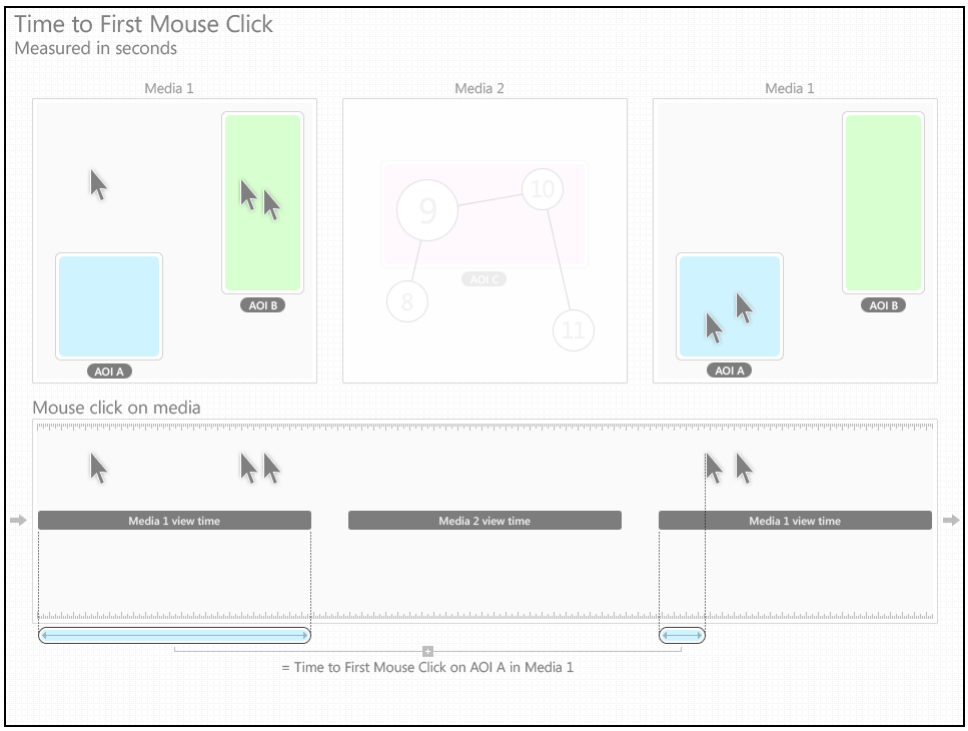
When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI Media Summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).



9.4.20.2 Brief description

The time from the start of the media display until the test participant left-clicks with the mouse on the AOI or AOI group for the first time (seconds).

9.4.21 Time to First Mouse Click (Across media) (seconds)

This metric measures how long it takes before a test participant left-clicks with the mouse on an active AOI or AOI group for the first time. The time measurement starts when the media containing the AOI is first displayed. For AOI groups, the time measurement starts when a media containing an AOI member of the group is first displayed. Time measurement stops when the participant left-clicks on the AOI if the AOI is active. For AOI groups, the time measurement stops when the participant left-clicks on any of the active AOIs belonging to the group.

If during the recording, media containing the same AOI is displayed several times, with media not containing the AOI in-between, Time to First Mouse Click (Across media) will be the sum of all recorded media time until the participant clicked the active AOI. **Recording time for Media not containing the AOI is included in the calculations.**

The activation state, **active/inactive,** of the AOI does not affect the counting starting point. Even if the AOI is **inactive,** time will be started and measured.

If at the end of the recording the participant has not clicked on the AOI, the Time to First Mouse Click value will not be computed and that recording will thus not be included in the descriptive statistics calculations (e.g. when computing N).

When browsing a website or PDF document, each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.

9.4.21.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

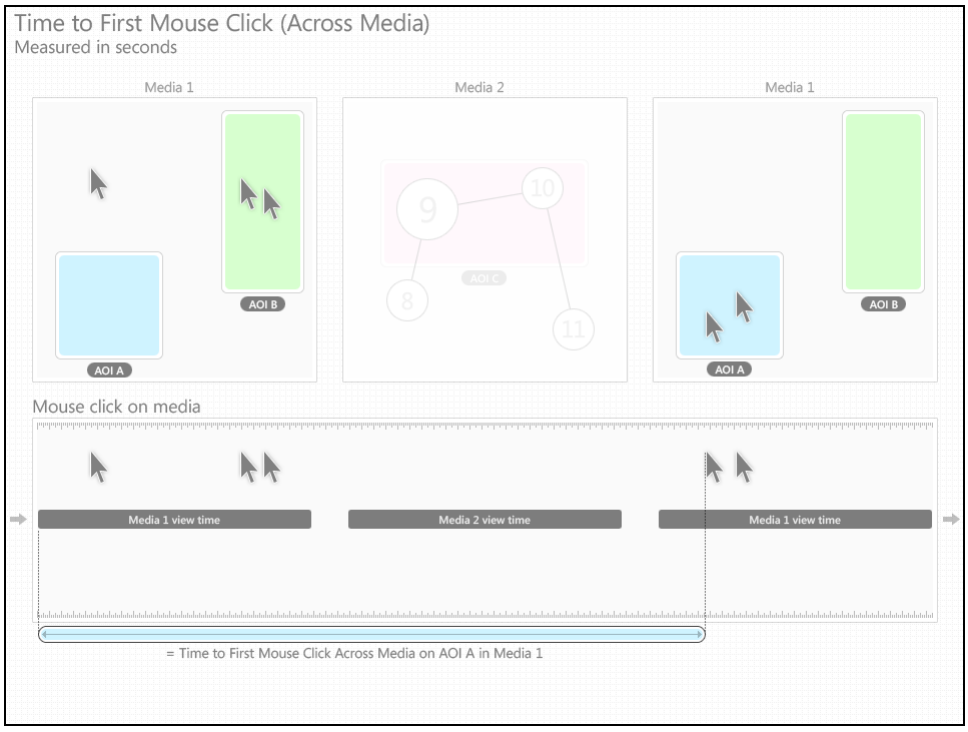
When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).



9.4.21.2 Brief description

The time from the start of the media display until the test participant left-clicks with the mouse on the AOI or AOI group for the first time (seconds), all media time included.

9.4.21.3 Aligning the metric starting time with the AOIs' active starting point in time

To start counting at the same time an AOI becomes active:

1. In the Areas of Interest tab, move the Time indicator slider to the key frame where the AOI becomes active.
2. Note the current time, displayed above the video controls.
3. In the **Statistics** tab, on the toolbar, click the **Media time...** button, the Media Time dialog opens.
4. In the Media Time dialog, enter the AOIs' start time you just noted and click **Done**. WARNING: Changing the data collection Starting Time will affect all metrics in the table.

9.4.22 Time from First Fixation to Next Mouse Click - seconds

This metric measures the time from the first fixation within an active AOI or AOI group until the participant left-clicks within the same active AOI or AOI group. The time measurement starts when the participant fixates on the active AOI for the first time and stops when the participant clicks on the same active AOI. When using AOI groups, the time measurement starts and stops when the participant fixates and clicks on any of the active AOIs belonging to the group.

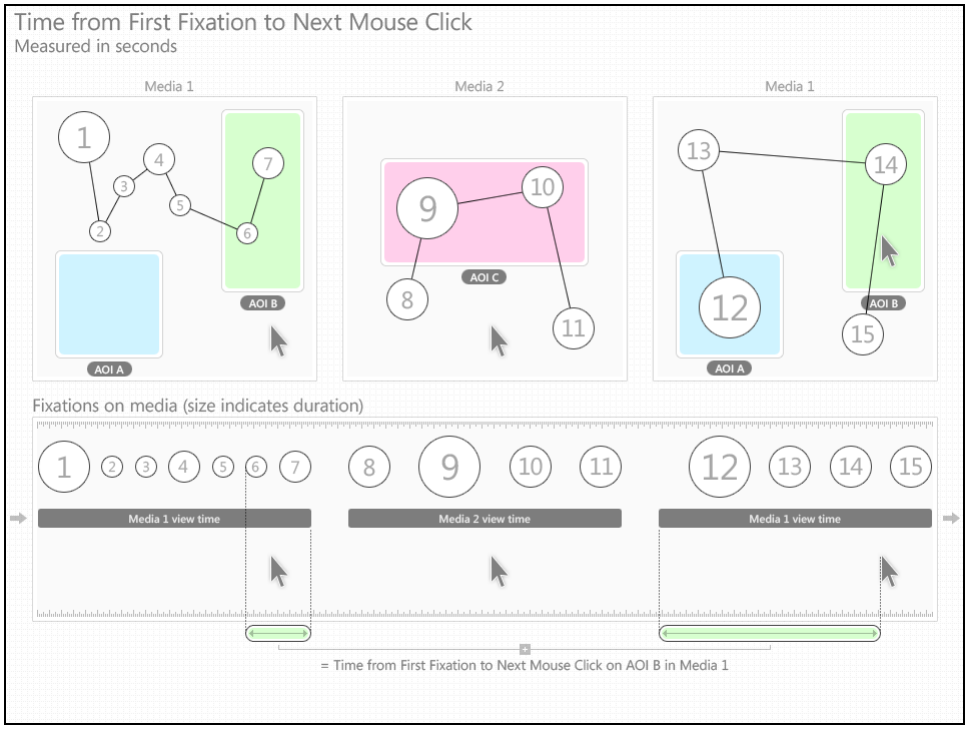
If during the recording, media not containing the AOI is viewed between the first fixation on the active AOI and the mouse click in the active AOI, Time from First Fixation to Next Mouse Click will be calculated by adding each recorded media time of the media containing the AOI until the participant clicked the active AOI. **Recording time of media not containing the AOI is excluded from the calculations**.

The activation state, **active/inactive,** of the AOI does not affect the counting starting point. Even if the AOI is **inactive,** time will be started and measured.

If at the end of the recording the participant has not fixated and clicked on the AOI, the Time from First Fixation to First Mouse Click value will not be computed and that recording will thus not be included in the descriptive statistics calculations (e.g. when computing N).

When browsing a website or PDF document, each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.


Time from First Fixation to Next Mouse Click
Measured in seconds
Media 1
Media 2
Media 1
AOI A
AOI B
AOI C
AOI B
AOI A
Fixations on media (size indicates duration)
Media 1 view time
Media 2 view time
Media 1 view time
= Time from First Fixation to Next Mouse Click on AOI B in Media 1

9.4.22.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).

9.4.22.2 Brief description

The time from the first fixation on an AOI until the test participant left-clicks with the mouse on the AOI or AOI group for the first time (seconds).

9.4.23 Time from First Fixation to Next Mouse Click (Across media) - seconds

This metric measures the time from the first fixation within an active AOI or AOI group until the participant left-clicks within the same active AOI or AOI group. The time measurement starts when the participant fixates on the AOI for the first time and it stops when the participant clicks on the same AOI. When using AOI groups, the time measurement starts and stops when the participant fixates and clicks on any of the AOIs belonging to the group.

If during the recording, media not containing the AOI is viewed between the first fixation on the AOI and the mouse click in the AOI, Time from First Fixation to Next Mouse Click (Across media) will be the sum of all recorded media time until the participant clicked the active AOI. **Recording time for media not containing the AOI is included in the calculations**.

The activation state, **active/inactive,** of the AOI does not affect the counting starting point. Even if the AOI is **inactive,** time will be started and measured.

If at the end of the recording the participant has not fixated and clicked on the AOI, the Time from First Fixation to First Mouse Click value will not be computed and that recording will thus not be included in the descriptive statistics calculations (e.g. when computing N).

When browsing a website or PDF document, each visited web (URL)[1] and PDF page will become a unique media element.

[1] If the Web Groups tool is used to group two or more URLs, the group and not the URL will become a unique media element.

9.4.23.1 N value

This statistic describes the N value used to calculate other descriptive statistics, such as the mean and standard deviation. In the current metric it represents the number of recordings and is calculated as follows:

Row settings

When recordings are selected as table rows, the N value will always be equal to 1.

If participants are selected as table rows, the N value will be equal to the number of recordings that participant has made (with the same media element).

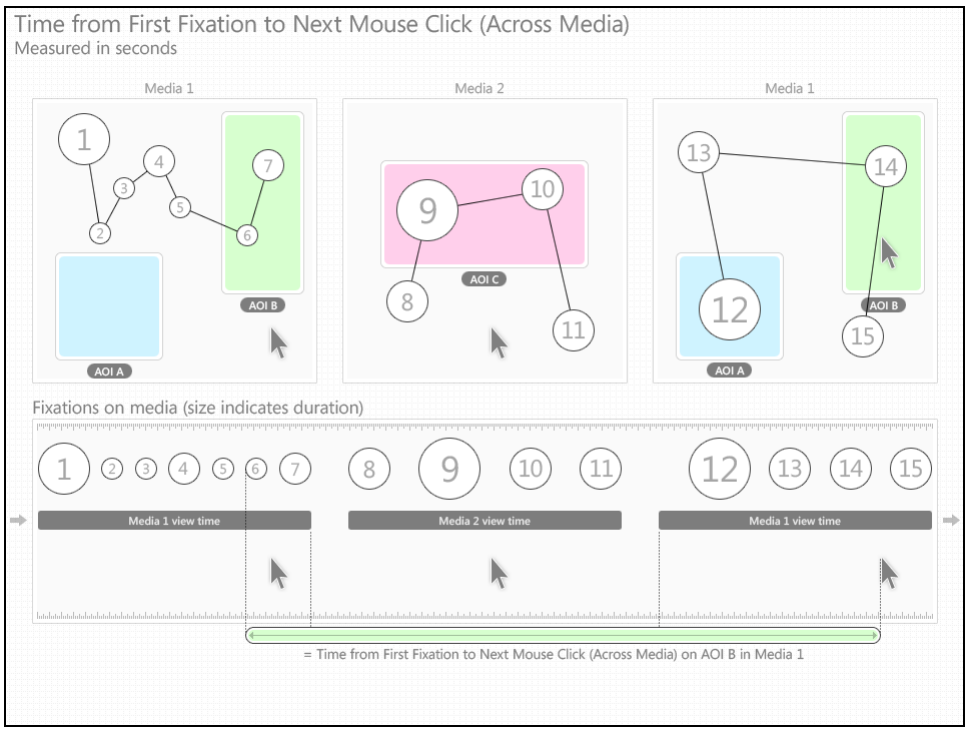
When participant groups are selected as rows, then the N value will be equal to the number of recordings included in the group.

Summary columns

In the AOI media summary columns, the N value represents the number of recordings x the number of AOIs included in a single media element.

In the AOI group summary columns, the N value represents the number of recordings and follows the rules described in the previous paragraph (row settings).

In the AOI metric summary columns, the N value represents the number of recordings x the total number of AOIs (i.e. all AOIs included in all media elements).


Time from First Fixation to Next Mouse Click (Across Media)
Measured in seconds
Media 1
Media 2
Media 1
AOI A
AOI B
AOI C
AOI B
AOI A
Fixations on media (size indicates duration)
Media 1 view time
Media 2 view time
Media 1 view time
= Time from First Fixation to Next Mouse Click (Across Media) on AOI B in Media 1

9.4.23.2 Brief description

The time from the first fixation on an AOI until the test participant left-clicks with the mouse on the AOI or AOI group for the first time (seconds).

9.5 Copying tables and charts to the clipboard

Use the copy function to quickly copy a table or chart from the Statistics view into a document.

To copy a table or chart:

1. Click the Copy button to show the Copy menu.
2. Select Copy Table or Copy Chart. The table/chart is copied to the clipboard.
3. Use the paste function in your document editor, or use the paste keyboard shortcut (English keyboards – CTRL+V) to paste the image (BMP file) or table (TXT file) content into your document.

9.6 Table and chart export

Use the export function in the Statistics view to save the table or chart into a file that you can later import or add to a document.

To export a table:

1. Click the Export button to show the Export menu.
2. Select Export Table. The Save As dialog box opens.
3. Type the file name, select the location where you want to save your export, then click Save. The table is exported as a tab-delimited TXT file.

To export a chart:

1. Click the Export button to open the Export menu.
2. Select Export Chart. The Save As dialog box opens.
3. Type the file name, select the location where you want to save your export and then click Save. The table is exported as an image in the PNG file format.

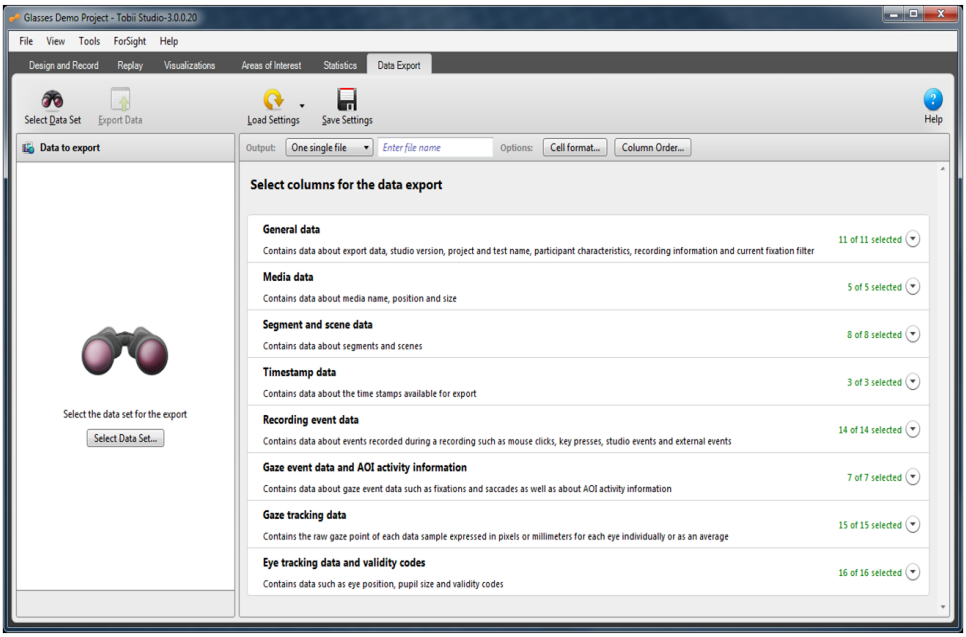
If more than one metric is chosen for analysis, the image file will contain all the generated charts.

10 Exporting Data

Eye and gaze tracking data exports can be used to analyze data from Tobii Studio in other analysis or statistics software such as Excel, SPSS or Matlab. The data is saved in a tab-separated values file (.tsv) or in a Microsoft Excel file (.xls) and follows the Unicode standard. The data export output file(s) can easily be imported into other software such as SPSS or Matlab. (When importing into such software, be sure to import through the software file menu dialog, do not "drag and drop").

Note: The .xlsx-format only allows for 1,048,576 rows in an exported file. Exports from recordings containing more samples than this will result in files not containing data from the complete recording. Another aspect of using the .xlsx format is that the export will take roughly 10 times longer than if it is done using the .tsv format.

To open the Tobii Studio Data Export tool, click the **Data Export** tab:


Glasses Demo Project - Tobii Studio-3.0.0.20
File View Tools ForSight Help
Design and Record Replay Visualizations Areas of Interest Statistics Data Export
Select Data Set
Export Data
Load Settings
Save Settings
Help
Data to export
Output: One single file
Enter file name
Options:
Cell format...
Column Order...
Select the data set for the export
Select Data Set...
Select columns for the data export
General data
Contains data about export data, studio version, project and test name, participant characteristics, recording information and current fixation filter
11 of 11 selected
Media data
Contains data about media name, position and size
5 of 5 selected
Segment and scene data
Contains data about segments and scenes
8 of 8 selected
Timestamp data
Contains data about the time stamps available for export
3 of 3 selected
Recording event data
Contains data about events recorded during a recording such as mouse clicks, key presses, studio events and external events
14 of 14 selected
Gaze event data and AOI activity information
Contains data about gaze event data such as fixations and saccades as well as about AOI activity information
7 of 7 selected
Gaze tracking data
Contains the raw gaze point of each data sample expressed in pixels or millimeters for each eye individually or as an average
15 of 15 selected
Eye tracking data and validity codes
Contains data such as eye position, pupil size and validity codes
16 of 16 selected

The Data Export tool has 4 main areas:

- Data export toolbar – This is where you find the following tools:
  - Select Data Set – allows you to select the type of export you want to perform. You can choose to export Full Recordings, Segments, or Media.
  - Export Data – click this to perform the export, after selecting the data to be exported
  - Load Settings – allows you to load an existing set of data to be exported.
  - Save Settings – allows you to save the currently selected set of data, so that you can load it at a later point in time.
- Data to export pane – This is where you can select and view the data set for the data export, after you have previously selected the data set.
- Data export columns/types selection area – This is where you select what data types you would like to include in the data export file.
- Output toolbar – This is where you define the export data file properties, such as file name and column order.

To export data from Tobii Studio, you need to define:

1. The data set: What are the data sources (Full recordings, Segments or Media)? Read *10.1 Selecting the data set from which data is exported*
2. Data types: What types of data would you like to see in you exported file? Read *10.2 Selecting the data types to be included in the data export*
3. Export data file properties: How should the data export file be formatted and where should it be written? read the following sections:

- *10.3 Defining the column order of the data export output file*
- *10.4 Setting the number of data export output files*
- *10.5 Defining the data cell format of the data export output file*
- *10.6 Setting the file name of the data export output file*

10.1 Selecting the data set from which data is exported

To select the data set from which data is exported:

1. To open the Data set dialog, do one of the following:
   - On the toolbar, click the Select Data Set button
   - In the Data to export pane on the left, click the Select Data Set...button
2. In the Data set dialog, click the data set category from which you want to export data:
   - **Full Recordings** exports data from entire recordings. Note: When exporting Tobii Glasses recordings data, the fixation filter settings in the global settings dialog will **not** be applied to the data, but the "Raw filter" will be applied.
   - **Segments** exports data from segments created within the recordings separately.
   - **Media** exports data collected for each recording for different media types, e.g., images, web pages, movies, scenes and **Tobii Glasses snapshots**. Note: When exporting Tobii Glasses snapshots data, the fixation filter settings in the global settings dialog will be applied to the data.
3. For the relevant test listed, click the drop-down button to show the available data sources for the specific test
4. To define the data set, select the checkboxes of the relevant data sources and click **Done**. Information given for each entry:
   - **Full Recordings**: Information about each recording includes participant name, recording name, date and time of when the recording was made and the duration of the recording
   - **Segments**: Information about each segment includes participant name, recording name for the recording in which the segment is created, segment name, date and time of when the recording in which the segment is created was made and the duration of the segment.
   - **Media**: Information for each entry is what type of media it is and the media element's name.

You can select all entries simultaneously by selecting the topmost checkbox.

10.2 Selecting the data types to be included in the data export

In the Data Export tool there are multiple types of data available for export. You should consider using one of the predefined data export settings available through the **Load Settings** button on the Data Export toolbar. These predefined data export settings are further described in section 4.9.

To simplify navigation among the available data types, the types are divided into groups. By default, all available data types are preselected for all groups. A complete list of data types with descriptions is found in section 4.10.

When the Data Export tool is opened, all groups are collapsed. To the right, next to the arrow icons, the number of selected data types and available types is shown (e.g. *"4 of 4 selected"*).

To select all data types in one group at the same time if they are not all selected can be done by ticking this tick box. Selecting or deselecting individual data types for export is done by ticking the tick box next to the data type name.

To select the data types to be included in the data export:

1. Click a group name or the drop-down arrow to the right of the group row, to see the data types available in a group.
2. Select the checkboxes of the data types that you would like to include in the exported data. Note: To deselect all data types for a group, deselect the topmost checkbox in the group. Selecting it will select all data types for that group.
3. Repeat steps 1 and 2 for all relevant groups

A complete list of data types with descriptions is found in section 4.10.

10.3 Defining the column order of the data export output file

It is possible to change the order in which data types are presented in the data export file. As each selected data type results in a column in the exported file, arranging the order of the data types affects the order of the columns in the exported file.

To define the column order of the data export output file:

1. On the Output toolbar, click the **Column Order...** button to open the Column Order dialog.
2. In the Column order dialog, click and drag the data types to their new position in the list. Then click **Done**. Note: You can also enter a number in the number field to define the position of the data type.

Click Reset Defaults to restore order to default order.

10.4 Setting the number of data export output files

To set the number of output files to be created:

If "One single file" is selected, all the data for each data source will be written in succession in one single file. If "Individual files' is selected separate files will be created for each data source.

1. Click the "One single file"/"Individual files" drop-down menu
2. In the drop-down menu, select the appropriate alternative.

If there are a large number of participants and the recordings are long, consider exporting to individual files, or else the output data file may be too large to handle for the software in which you are importing it.

10.5 Defining the data cell format of the data export output file

In order to provide maximum flexibility in terms of what software the exported data can be imported into, it is possible to specify what characters should be used as a decimal point separator and to symbolize that no data is available.

To define the data cell format of the data export output file:

1. On the Output toolbar, click the **Cell format...** button to open the Dell format dialog.
2. In the Cell format dialog, in the Decimal Point field, enter a character to be used as decimal point.
3. In the Cell format dialog, in the No Value field, enter a character to symbolize "no data available".
4. Click **Done**.

10.6 Setting the file name of the data export output file

Depending on whether *One single file* or *Individual files* is selected, different options are given for naming the exported file(s).

To enter a filename, do one of the following:

- If "One single file" is selected, enter the filename in the **Enter file name** field. Note: If no text is entered, the file name will be on the format "ProjectName_Data_Export.tsv".
- If "Individual files" is selected:

1. Click the **Naming...** button to open the File naming dialog.
2. In the File naming dialog select the **Project name** checkbox if the project name should be included in the file name.
3. In the File naming dialog select the **Test name** checkbox if the test name should be included in the file name.
4. In the File naming dialog select the **Additional** checkbox if you want to add additional characters to the file name.
5. Click **Done**.

10.7 Saving the data export output file

To save the data export output file:

1. On the Data Export toolbar, click the **Export Data** button to open the Browse For Folder dialog.
2. In the Browse For Folder dialog, navigate the appropriate folder for the data export output file and click **OK**.

You can create a new folder in the currently selected folder, by clicking the Make New Folder button.

10.8 Saving and Loading Data Export Settings

Data export settings can be saved to be used in later or in other projects. The saved settings include:

- Data types selected.
- Output number of files: One single file /Individual files.
- File name configuration for Individual files export.
- Column order.
- Cell format.

The data set selection is not saved in the settings.

To save Data Export settings:

1. Make sure current settings are correct.
2. To open the save current settings dialog, click the **Save Settings** button on the Data Export toolbar.
3. In the Save current settings dialog, enter a settings name and click **OK**.

To load a Data Export setting:

1. On the Data Export toolbar, click the **Load Settings** button. A drop-down menu appears.
2. In the drop-down menu, locate the proper settings and click it to apply the settings. Note: There is a number of predefined Data Export settings in Tobii Studio described in the following section.

10.9 Predefined data export settings

Tobii Studio provides a number of predefined settings that are relevant from a user application perspective. The following sections will describe all available predefined settings.

To load a predefined data export setting:

1. On the Data Export toolbar, click the Load Settings button. A drop-down menu appears.
2. In the drop-down menu, locate the proper settings and click it to apply the settings.

10.9.1 Coding Scheme Events – predefined settings

Export events that have been manually logged (Created Log Entries) in Tobii Studio. This setting is applicable for all types of recordings including Tobii Glasses.

Column	Included data type
1	ParticipantName
2	RecordingName
3	RecordingDate
4	StudioTestName
5	MediaName
6	RecordingTimestamp

Column	Included data type
7	StudioEvent
8	StudioEventData

10.9.2 AOI Gaze events – predefined settings

Export gaze events (fixations, saccades) for each AOI.

Column	Included data type
1	ParticipantName
2	RecordingName
3	RecordingDate
4	FixationFilter
5	StudioTestName
6	MediaName
7	RecordingTimestamp
8	GazeEventType
9	GazeEventDuration
10	AOI[Name of AOI]Hit

10.9.3 Media gaze events and coordinates – predefined settings

Export gaze events (fixations, saccades) for each media.

Column	Included data type
1	ParticipantName
2	RecordingName
3	RecordingDate
4	FixationFilter
5	StudioTestName
6	MediaName
7	MediaWidth
8	MediaHeight
9	RecordingTimestamp
10	GazeEventType
11	GazeEventDuration
12	FixationPointX (MCSpx)
13	FixationPointY (MCSpx)
14	GazePointX (MCSpx)
15	GazePointY (MCSpx)

10.9.4 Glasses gaze coordinates

Export X, Y gaze coordinates from a Tobii Glasses recording

Column	Included data type
1	ParticipantName
2	RecordingName
3	RecordingDate
4	StudioTestName
5	MediaName
6	MediaWidth
7	MediaHeight
8	RecordingTimestamp
9	StudioEvent
10	StudioEventData
11	GazePointX(MCSpx)
12	GazePointY(MCSpx)

10.9.5 Raw gaze coordinates – predefined settings

Export raw X, Y gaze coordinates.

Column	Included data type
1	ParticipantName
2	RecordingName
3	RecordingDate
4	StudioTestName
5	MediaName
6	RecordingResolution
7	RecordingTimestamp
8	EyeTrackerTimestamp
9	GazePointLeftX (ADCSpx)
10	GazePointLeftY (ADCSpx)
11	ValidityLeft
12	GazePointRightX (ADCSpx)
13	GazePointRightY (ADCSpx)
14	ValidityRight

10.10 Definitions of available data types

This section defines available data types and their reference systems.

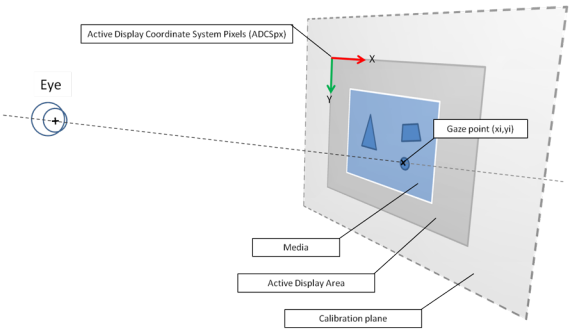
Glasses note: For parallax compensated Tobii Glasses recordings, all exported gaze data has been remapped according to the set distances. Consult the Tobii Glasses user manual for further information about parallax compensation.

10.10.1 Coordinate systems

All gaze data in Tobii Studio is mapped into a coordinate system. There are three available coordinate systems, described in the following sections.

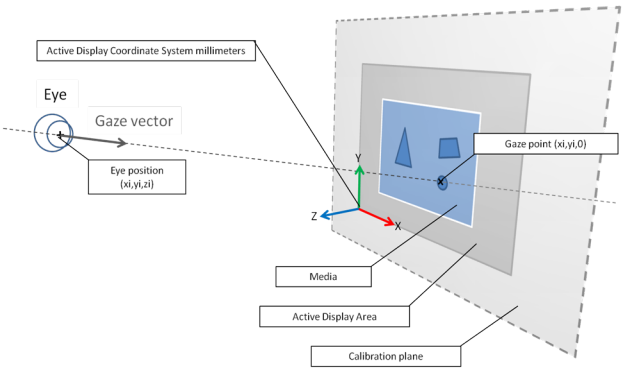
10.10.1.1 Active Display Coordinate System pixels - ADCSpx

Data types with the extension ADCSpx provide data mapped into a 2D coordinate system aligned with the Active Display Area. When using a T-series eye tracker, the Active Display Area is the screen area. For X-series eye trackers the Active Display Area is the display area entered in the X configuration tool. The origin of the "Active Display Coordinate System pixel" (ADCSpx) is at the upper left corner of the Active Display Area, as illustrated in figure below. For Tobii Glasses recordings, the origin is at the top left of the scene camera video.



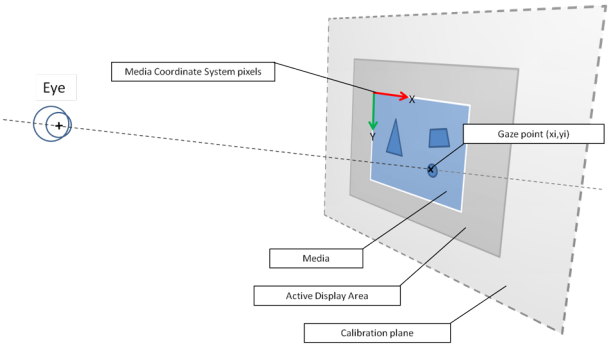
10.10.1.2 Active Display Coordinate System millimeters - ADCSmm

Data types with the extension ADCSmm provide data mapped into a 3D coordinate system aligned with the Active Display Area. When using a T-series eye tracker, the Active Display Area is the screen area. For X-series eye trackers, the Active Display Area is the display area entered in the X configuration tool (please consult the eye tracker's user manual for further information). The origin of the "Active Display Coordinate System millimeter" (ADCSmm) is at the bottom left corner of the Active Display Area, as illustrated in figure below. For Tobii Glasses recordings, data types using this coordinate system will not provide any data.



10.10.1.3 Media Coordinate System pixels – MCSpx

Data types with the extension MCSpx provide data mapped into a 2D coordinate system aligned with the media. The origin of the coordinate system is at the top left of the media shown to the participant being eye tracked. If a scene camera or external video is used as stimuli, the origin will be at the top left of the captured video. For Tobii Glasses recordings, the origin is at the top left of the scene camera video.



10.10.2 General data

This group of data types provides general information such as information about the project, test, participant and recording and fixation filter used.

General data	Description	Format
ExportDate	Date when the file was exported (date of export)	YYYYMMDD
StudioVersionRec	Tobii Studio release version used to perform the recording	
StudioProjectName	Name of the Tobii Studio project	
StudioTestName	Name of the Tobii Studio Test	
ParticipantName	Name of the Participant associated with the Tobii Studio recording	
[VariableName]Value	Displays the independent variable values associated with the participant. Enabling this column generates one column per independent variable.	
RecordingName	Name of the Recording	
RecordingDate	Date when the recording was performed	YYYYMMDD
RecordingDuration	The duration of the recording	Milliseconds
RecordingResolution	The resolution of the screen or of the video capture device used during the recording	Pixels (horizontal x vertical)
PresentationSequence	The name of the presentation sequence used during the recording.	
FixationFilter	The fixation filter applied when the data was exported	I-VT filter, Raw filter, Tobii fixation filter, Clearview filter,

For data types that provide date information, the actual format of the exported values depends on the used computer's locale settings, i.e. it is determined by settings in the Microsoft Windows operating system.

10.10.3 Media data

This group of data types provides information about the media that is displayed to the participant. It includes media name, position and resolution.

Media data	Description	Format	Reference system
MediaName	Name of the media/stimuli element from the Tobii Studio test timeline.		
MediaPosX (ADCSpx)	Horizontal coordinate of the left edge of the eye tracked media.	Pixels	ADCSpx
MediaPosY	Vertical coordinate of the top edge of the eye tracked media	Pixels	ADCSpx
MediaWidth	Horizontal size of the eye tracked media	Pixels	
MediaHeight	Vertical size of the eye tracked media	Pixels	

10.10.4 Segment and scene data

This group of data types provides information about the segments and scenes created in the Tobii Studio project. These data types only provide data if the data set was defined by choosing segments or scenes specifically.

Segment and scene data	Description	Format	Reference system
SegmentName	Name of segment.	Milliseconds	
SegmentStart	Start time for segment	Milliseconds	RecordingTImestamp
SegmentEnd	End time for segment	Milliseconds	RecordingTimestamp
SegmentDuration	Duration of segment	Milliseconds	
SceneName	Name of the Scene selected for export in the Select Media for Export option.		
SceneSegmentStart	Start time for each segment belonging to a scene.	Milliseconds	RecordingTimestamp
SceneSegmentEnd	End time for each segment belonging to a scene.	Milliseconds	RecordingTimestamp
SceneSegmentDuration	Duration of each segment belonging to a scene.	Milliseconds	

10.10.5 Timestamp data

This group of data types provides timestamps for sampled data and events.

Timestamp data	Description	Format
RecordingTimestamp	Timestamp counted from the start of the recording (t0=0). This timestamp is based on the internal computer clock of the computer running Tobii Studio. This clock is regularly synchronized with the eye tracker clock in order to ensure that the timestamps of the gaze data is accurate in relation to other events such as when media is shown or participant generated events such as mouse clicks.	Milliseconds
LocalTime	Recording computer local *date time value* timestamp. This provides the timestamp from the internal clock of the computer running Tobii Studio, in the data format	Hour: Minutes: Seconds, Milliseconds
EyeTrackerTimestamp	Timestamp obtained from the eye tracker firmware (TET server) clock. The source of this timestamp is the internal clock in the eye tracker hardware. This timestamp shows the time when a specific gaze data sample was sampled by the eye tracker. The value should be interpreted as a value counted in microseconds from some unknown point in time.	Microseconds

10.10.6 Recording Event Data

This group of data types provides data describing events generated by the participant, the user and Tobii Studio.

Recording event data	Description	Format	Reference system
MouseEventIndex	Represents the order in which a mouse click event was recorded. The index is an auto-increment number starting at 1(first mouse event detected)	Count	
MouseEvent	Mouse click type: Left button and Right button		
MouseEventX (ADCSpx)	Horizontal coordinate of the mouse event location on the screen.	Pixels	ADCSpx
MouseEventY (ADCSpx)	Vertical coordinate of the mouse event location on the screen.	Pixels	ADCSpx
MouseEventX (MCSpx)	Horizontal coordinate of the mouse event location on the media element	Pixels	MCSpx
MouseEventY (MCSpx)	Vertical coordinate of the mouse event location on the media element.	Pixels	MCSpx
KeyPressEventIndex	Represents the order in which a key press event was recorded. The index is an auto-increment number starting with 1 (first key press event detected)	Count	
KeyPressEvent	Displays the information of which key was pressed on the keyboard.		
StudioEventIndex	Represents the order in which a Tobii Studio recording event was registered. The index is an auto-increment number starting with 1 (first event detected)	Count	
StudioEvent	Type of media element or manual logging event (e.g. start, end and manual logging description. For further information please read the following section)		
StudioEventData	Displays the name of the media element, webpage URL or PDF page. For Manual logging it displays the text entered in the log message. (For further information please read the following section)		
ExternalEventIndex	Represents the order in which external events were logged during the recording. The index is an auto-increment number starting with 1 (first event detected)	Count	
ExternalEvent	Type of event logged by an external device.		
ExternalEventValue	Value of external event.		
EventMarkerValue	Reports whether the signal on the TX300's sync port is off or on: • 0=off • 1=on		

10.10.6.1 StudioEvent/StudioEventData

The table below describes the Tobii Studio generated events in detail.

StudioEvent	StudioEventData	Description
InstructionStart	The name of the instruction element on the timeline.	
InstructionEnd	The name of the instruction element on the timeline	
ImageStart	The name of the image file	
ImageEnd	The name of the image file	

StudioEvent	StudioEventData	Description
MovieStart	The name of the movie file	
MovieEnd	The name of the movie file	
ScreenRecStarted	N/A	This event is created when a screen recording starts. When a web stimulus is used, there will be a ScreenRecStarted event before the web browser gets launched and a ScreenRecEnded when the web browser gets closed either manually or by stepping to the next element on the timeline.
ScreenRecEnded	N/A	This event is created when a screen recording starts. When a web stimulus is used, there will be a ScreenRecStarted event before the web browser gets launched and a ScreenRecEnded when the web browser gets closed either manually or by stepping to the next element on the timeline.
URLStart	The URL of the webpage shown	
URLEnd	The URL of the webpage shown	
QuestionEnded	The question text	
PDFPageStarted	The name of the PDF file_ pagenumber	
PDFPageEnded	The name of the PDF file_ pagenumber	
GlassesRecording-Started	N/A	This event is created when the recording imported from the glasses recording unit starts.
GlassesRecordin-gEnded	N/A	This event is created when the recording imported from the glasses recording unit ends.
[Log name]	[Log description]	This event is created by the use of the built-in coding scheme feature in Tobii Studio and generated by the action of a person creating logs manually. The name and the description of the event are determined by the Tobii Studio user creating the logs.

The data types StudioEvent and StudioEventData have replaced the earlier Tobii Studio versions' data types Event, Data1, Data2 and Descriptor. The data types listed for versions prior to Tobii Studio 3.0 also contained data regarding mouse clicks and key presses. In Tobii Studio 3.0, mouse events and key press events have separate data types (MouseEventIndex, MouseEvent, MouseEventScreenX, MouseEventScreenY, MouseEventMappedToMediaX, MouseEventMappedToMediaY, KeyPressEventIndex, KeyPressEvent).

10.10.7 Gaze event data and AOI activity information

This group of data types provides data describing gaze events classified by the applied fixation filter.

Gaze event data and AOI activity information	Description	Format	Reference system
FixationIndex	Represents the order in which a fixation event was recorded. The index is an auto-increment number starting with 1 (first gaze event detected).	Count	
SaccadeIndex	Represents the order in which a saccade event was recorded. The index is an auto-increment number starting with 1 (first gaze event detected).	Count	
GazeEventType	Type of eye movement event classified by the fixation filter settings applied during the gaze data export.	Fixation; Saccade; Unclassified.	

Gaze event data and AOI activity information	Description	Format	Reference system
GazeEventDuration	Duration of an eye movement event	Milliseconds	
FixationPointX (MCSpx)	Horizontal coordinate of the fixation point on the media. Column empty if: • Fixation is outside media • Media is covered • No media is displayed This column is affected by the settings in the Fixation Filter Tab (in Global Settings)	Pixels	MCSpx
FixationPointY (MCSpx)	Vertical coordinate of the fixation point on the media. Column empty if: • Fixation is outside media • Media is covered • No media is displayed This column is affected by the settings in the Fixation Filter Tab (in Global Settings)	Pixels	MCSpx
AOI [Name of AOI] Hit	Report whether the AOI is active and whether the fixation is located inside of the AOI • Empty = the media on which the AOI is positioned is inactive • -1 = AOI Inactive • 0 = AOI active, the fixation is not located in the AOI • 1 = AOI active and the fixation point is located inside of the AOI. Enabling this column generates one column per AOI.	Empty;-1;0;1	

10.10.8 Gaze tracking data

This group of data types provides unprocessed eye gaze data (with the exception of averaging the coordinates of both eyes, for data types where the data is not provided separately for left and right eye).

Gaze tracking data	Description	Format	Reference system
GazePointIndex	Represents the order in which the gaze sample was acquired by Tobii Studio from an eye tracker. The index is an auto-increment number starting with 1 (first gaze sample)	Count	
GazePointLeftX (ADCSpx)	Horizontal coordinate of the unprocessed gaze point for the left eye on the screen.	Pixels	ADCSpx
GazePointLeftY (ADCSpx)	Vertical coordinate of the unprocessed gaze point for the left eye on the screen.	Pixels	ADCSpx
GazePointRightX (ADCSpx)	Horizontal coordinate of the unprocessed gaze point for the right eye on the screen.	Pixels	ADCSpx
GazePointRightY (ADCSpx)	Vertical coordinate of the unprocessed gaze point for the right eye on the screen.	Pixels	ADCSpx
GazePointX (ADCSpx)	Horizontal coordinate of the averaged left and right eye gaze point on the screen.	Pixels	ADCSpx

Gaze tracking data	Description	Format	Reference system
GazePointY (ADCSpx)	Vertical coordinate of the averaged left and right eye gaze point on the screen.	Pixels	ADCSpx
GazePointX (MCSpx)	Horizontal coordinate of the averaged left and right eye gaze point on the media element. Column empty if: • Fixation is outside media • Media is covered • No media is displayed	Pixels	MCSpx
GazePointY (MCSpx)	Vertical coordinate of the averaged left and right eye gaze point on the media element. Column empty if: • Fixation is outside media • Media is covered • No media is displayed	Pixels	MCSpx
GazePointLeftX (ADCSmm)	Horizontal coordinate of the unprocessed gaze point for the left eye on the screen.	Millimeters	ADCSmm
GazePointLeftY (ADCSmm)	Vertical coordinate of the unprocessed gaze point for the left eye on the screen.	Millimeters	ADCSmm
GazePointRightX (ADCSmm)	Horizontal coordinate of the unprocessed gaze point for the right eye on the screen.	Millimeters	ADCSmm
GazePointRightY (ADCSmm)	Vertical coordinate of the unprocessed gaze point for the right eye on the screen.	Millimeters	ADCSmm
StrictAverageGazePointX (ADCSmm)	Horizontal coordinate of the averaged gaze point for both eyes on the screen. "average" function similar to the one used for Eye selection.	Millimeters	ADCSmm
StrictAverageGazePointY (ADCSmm)	Vertical coordinate of the averaged gaze point for both eyes on the screen. "average" function similar to the one used for Eye selection.	Millimeters	ADCSmm

10.10.9 Eye tracking data and validity codes

This group of data types provides unprocessed data describing the characteristics about the participants' eyes.

Gaze tracking data	Description	Format	Reference system
EyePosLeftX (ADCSmm)	Horizontal coordinate of the 3D position of the left eye.	Millimeters	ADCSmm
EyePosLeftY (ADCSmm)	Vertical coordinate of the 3D position of the left eye.	Millimeters	ADCSmm
EyePosLeftZ (ADCSmm)	Distance/depth coordinate of the 3D position of the left eye.	Millimeters	ADCSmm
EyePosRightX (ADCSmm)	Horizontal coordinate of the 3D position of the right eye.	Millimeters	ADCSmm
EyePosRightY (ADCSmm)	Vertical coordinate of the 3D position of the right eye.	Millimeters	ADCSmm
EyePosRightZ (ADCSmm)	Distance/depth coordinate of the 3D position of the right eye.	Millimeters	ADCSmm

Gaze tracking data	Description	Format	Reference system
DistanceLeft	Distance between the left eye and the eye tracker. The distance is calculated based on the length of the vector from the center of the eye to the UCS origin point (User Coordinate System) on the eye tracker.	Millimeters	
DistanceRight	Distance between the right eye and the eye tracker. The distance is calculated based on the length of the vector from the center of the eye to the UCS origin point (User Coordinate System) on the eye tracker.	Millimeters	
CamLeftX	Horizontal coordinate of the left eye in the eye tracker sensor image – only available for recordings made with Tobii Studio versions prior to Tobii Studio 2.3.		0 is the left edge of the image, 1 is the right edge
CamLeftY	Vertical coordinate of the left eye in the eye tracker sensor image – only available for recordings made with Tobii Studio versions prior to Tobii Studio 2.3.		0 is the top edge of the image, 1 is the bottom edge
CamRightX	Horizontal coordinate of the right eye in the eye tracker sensor image – only available for recordings made with Tobii Studio versions prior to Tobii Studio 2.3.		0 is the left edge of the image, 1 is the right edge
CamRightY	Vertical coordinate of the right eye in the eye tracker sensor image – only available for recordings made with Tobii Studio versions prior to Tobii Studio 2.3.		0 is the top edge of the image, 1 is the bottom edge.
PupilLeft	Estimated size of the left eye pupil. The Tobii Eye Trackers aim to measure the true pupil size, i.e. the algorithms take into account the magnification effect given by the spherical cornea as well as the distance to the eye.	Millimeters	
PupilRight	Estimated size of the right eye pupil. The Tobii Eye Trackers aim to measure the true pupil size, i.e. the algorithms take into account the magnification effect given by the spherical cornea as well as the distance to the eye.	Millimeters	
PupilGlassesRight	Estimated value of the right pupil size in relation to the average value of the pupil during the calibration. The pupil size is measured during the recording and the calibration as the largest value of the diameter of the pupil as seen in the eye image.	%	
IRMarkerInfo	The ID numbers of the IR-Markers detected in the current sample. The information is presented as a comma separated list, ordered from the lowest ID to the highest ID.		
IRMarkerCount	The number of IR-Markers detected in the current sample.	Count	

Gaze tracking data	Description	Format	Reference system
ValidityLeft	Indicates the confidence level that the left eye has been correctly identified. The values range from 0 (high confidence) to 4 (eye not found).	0;1;2;3;4	
ValidityRight	Indicates the confidence level that the right eye has been correctly identified. The values range from 0 (high confidence) to 4 (eye not found).	0;1;2;3;4	

10.10.9.1 ValidityLeft/Right

The validity code is an estimate of how certain the eye tracker is that the data given for an eye really originates from that eye. The validity code scale starts at 0, which signifies eye certainly found, and stops at 4 which signifies eye not found. The validity codes can only appear in certain combinations. These combinations and their interpretations are summarized in the following table:

		Right Validity Code				
Left Validity Code		0	1	2	3	4
	0	Found two eyes	N/A	N/A	N/A	Found one eye. Most probably the left eye.
	1	N/A	N/A	N/A	Found one eye. Probably the left eye.	N/A
	2	N/A	N/A	Found one eye. The tracker cannot with any certainty determine which eye it is.	N/A	N/A
	3	N/A	Found one eye. Probably the right eye.	N/A	N/A	N/A
	4	Found one eye. Most probably the right eye.	N/A	N/A	N/A	No eyes found

11 Tobii Studio Remote Viewer

The Tobii Studio Remote Viewer is a separate software component that views an ongoing eye tracking recording session over a LAN connection. The Tobii Studio Remote Viewer displays the gaze point superimposed on the stimuli along with the user camera video. It also plays the user camera audio. The Tobii Studio Remote Viewer cannot be used in combination with Tobii Glasses, and is only available together with the Tobii Studio Enterprise edition.

- Use at least a Gigabit Ethernet (T1000) switches that supports “jumbo frames”.
- Do not install the Tobii Studio Remote Viewer on the same computer on which you have Tobii Studio Installed.

11.1 Installing Tobii Studio Remote Viewer

The Tobii Studio viewer software component and Tobii studio are run on two different computers and communicate with each other over a LAN network.

The Tobii Studio Remote Viewer installation file can be found on the Tobii Studio DVD or downloaded from the Tobii Updates Server: http://studiohelp.tobii.org/Updates/ .

Tobii Studio Remote Viewer might not be supported by your Tobii Studio, depending on the license type that you own. Please see the *1 Introduction*for a list of the features supported by each Tobii Studio license type.

To download and install the installation file:

1. Visit http://studiohelp.tobii.org/Updates/ and enter your Enterprise license key in the field and click Login.
2. Click the Remote Viewer download link to download the installation file.
3. Once downloaded, run the executable file and follow the on-screen instructions.

11.2 Enabling remote viewing from Tobii Studio

For the Tobii Studio Remote Viewer to be granted connection to the recording computer, remote viewing must be enabled in the Tobii Studio software.

To enable remote viewing:

- In the Design and Record tab, at the bottom right, click the Remote Live Viewing slider to change its status to ON.

The screen update rate in the Remote Viewer is dependant of the sizes and frame rates of the screen and user camera in the Tobii Studio. If the estimated bandwidth transmitting screen and user camera exceeds 210 Mbit/s, Remote Viewer screen update rate will be set to one frame per second (The upper limit is set to allow data transfer for a screen resolution of 1920x1200 at 5 fps). This limitation does not influence the screen capture frame rate of the screen recording or local Remote Viewer.

If the user camera is enabled, the recommended settings are 320x240 at 15 fps for the camera. Enabling remote viewing will force a change of the video codec for the user camera to “Microsoft video 1”.

11.3 Starting the Tobii Studio Remote Viewer

To start a remote viewing session:

1. Locate and start the Tobii Studio Remote Viewer application.
2. Make sure Tobii Studio is running on the recording computer and that Remote Viewing is enabled.
3. In the Tobii Studio Remote Viewer application, enter the IP address of the recording computer in the IP address text field, and click **Connect**.

The Tobii Studio Remote Viewer remembers the last 5 IP numbers and presents them in the IP address drop-down list/text field.

Tip: **To find the IP address of the recording computer (using the command prompt):**

1. On the recording computer, click the Windows Start button, select Run.

You can also press **Win + R** to open Run.

2. Type CMD and press Enter.
3. A Command prompt window will open. Type *ipconfig* and press Enter.
4. Several lines of information will be displayed. The IP address is on a line where it says “IPv4 Address” and looks like "149.72.61.234".

For Windows 7, without using the command prompt:

1. In the system tray, click the network connection icon and select Open Network and Sharing Center.
2. To view the IP address of:
   - Wired connection; click Local Area Connection.
   - Wireless adapter; click Wireless Network Connection (Network Name).
3. Click **Details**... The IP address is on a line where it says “IPv4 Address” and looks like "149.72.61.234".

In order to provide a smooth streaming, the Remote Viewer buffers about 10 seconds worth of data before presenting it on screen. This means that what is seen on the Tobii Studio Remote Viewer screen is what happened about 10 seconds ago on the Tobii Studio screen. If there are disruptions or disturbances on the network, in many cases it is possible for the Tobii Studio Remote Viewer to continue displaying the data without the viewer noticing any difference compared to if there were no disturbances.

The “Buffer Status” bar displays how much data is currently available in the buffer. If the bar is completely blue, the buffer is full and the replay will be running smoothly. However, if only a small part of the bar is blue, this indicates that the level of available data is low and the video quality will be poor or the streaming choppy. Typically, a slow LAN or a temporary large load of traffic on the network causes a low level of available data in the buffer.

11.4 Showing the Tobii Studio Remote Viewer in full screen

To show the Tobii Studio Remote Viewer in full screen mode, do one of the following:

- On the Tobii Studio Remote Viewer toolbar, click the full screen button.
- In the **View** menu, click **Fullscreen.**
- While the Tobii Studio Remote Viewer application window is active, press F11 on the keyboard.

To exit full screen mode, move the mouse curser to the top edge of the screen to roll down the ribbon bar, and then click the full screen button (or press F11).

11.5 Turning on and off viewing of the User Camera display

The Tobii Studio Remote Viewer is capable of receiving and displaying user video and audio. The User sound will always be transmitted as long as it is enabled in the Global settings of Tobii Studio. For the Tobii Studio Remote Viewer to be able to receive and display video from the user camera, the Record User Camera setting must be enabled in the Global settings of Tobii Studio

To turn on or off the User camera display in Tobii Studio Remote Viewer, do one of the following:

- On the Tobii Studio Remote Viewer toolbar, in the **View** drop-down menu, click **User Camera**.
- In the **View** menu, click **User Camera**.
- While the Tobii Studio Remote Viewer application window is active, press CTRL + U on the keyboard.

11.6 Changing the appearance of the User Camera display

To move the User Camera display window:

- Drag the User Camera display window to its new position.

To change the size of the User Camera display window:

- Drag the User Camera display window corner to resize the display window.

To change the opacity of the User Camera display:

1. Position the mouse on the User Camera display window, the Opacity control slider appears at the bottom of the User Camera display window.
2. On the Opacity control slider, drag the slider handle to change the opacity of the User Camera display.

11.7 Turning on and off the Gaze overlay

To turn the Gaze overlay in Tobii Studio Remote Viewer on or off, do one of the following:

- On the Tobii Studio Remote Viewer toolbar, in the **View** drop-down menu, click **Gaze Data Overlay**.
- In the **View** menu, click **Gaze Data Overlay**.
- While the Tobii Studio Remote Viewer application window is active, press CTRL + G on the keyboard.

11.8 Turning on and off the Mouse Click Overlay

To turn the Mouse Click Overlay in Tobii Studio Remote Viewer on or off, do one of the following:

- On the Tobii Studio Remote Viewer toolbar, in the **View** drop-down menu, click **Mouse Click Overlay**.
- In the **View** menu, click **Mouse Click Overlay**.
- While the Tobii Studio Remote Viewer application window is active, press CTRL + M on the keyboard.

11.9 Disconnecting from Tobii Studio

To disconnect the Tobii Studio Remote Viewer from Tobii Studio:

- On the Tobii Studio Remote Viewer toolbar, click the **Disconnect** button.

11.10 Troubleshooting and technical notes

11.10.1 Tobii Studio Remote Viewer firewall settings

As with all applications sending data over a network, it might be necessary to configure the firewalls involved in the setup.

The ports used by the applications, which should be opened:

- Tobii Studio recording computer: UDP 10200, 10201
- Tobii Studio Remote Viewer: UDP 11200, 11201

Due to differences in firewall implementations, no general guidelines can be given on how to configure the firewalls to allow for communication between Tobii Studio and the Tobii Studio Remote Viewer, but in most cases manually opening these ports will be sufficient. However, in some cases, the applications themselves have to be allowed to communicate over the network. Please consult your firewall manual for further information on how to open ports and allow applications to access the network.

11.10.2 Tobii Studio Remote Viewer LAN requirements

Transfer of video and audio over a network requires a high bandwidth. When using the Tobii Studio Remote Viewer **it is required to use a gigabit network that supports Jumbo frames**. Ideally, the network should be devoted to the transfer of data between the computer running Tobii Studio and the computer running the Tobii Studio Remote Viewer.

Jumbo frames are Ethernet frames with more than 1500 bytes of payload. Many Gigabit Ethernet switches and Gigabit Ethernet network interface cards support jumbo frames.

12 General Settings

Prior to a test session it is important to ensure that both the Tobii Studio software and the computer have been set up correctly. This ensures that the eye tracker will be able to communicate with Tobii Studio, that the stimulus is correctly displayed on the screen, and that data recording and analysis are performed according to your study objectives. This is particularly relevant if the eye tracking system is being used simultaneously in different studies or research projects and when different users have different requirements for their tests and analysis.

12.1 Computer settings

The Tobii T Series Eye Trackers are integrated into 17″ and 24″ TFT-LCD monitors, while the Tobii X Series Eye Trackers can be used with a wide range of screen sizes. It is important that when you prepare your eye tracking study, that you ensure that the computer running Tobii Studio is able to support the different screen resolutions and sizes. Thus the first thing to do after installing the software and eye tracking hardware is to ensure that the computer display settings are set correctly to run the eye tracking tests.

Resolution based on LCD monitor size:

Monitor size (where the stimulus is shown)	Recommended resolution (pixels)
17″ to 19″ standard ratio LCD	1280 x 1024
20″ standard ratio LCD	1600 x 1200
20″ to 22″ widescreen LCD	1680 x 1050
24″ widescreen LCD	1920 x 1200

The precision of the timing, for example, of the offset between the stimulus presentation and data recording can be improved by optimizing your computer settings for faster performance. Read *14.1.4 Recommendations* for information on how to optimize the eye tracking system for low offsets during data collection.

12.1.1 Setting up display resolution

During the eye tracking study, use the same resolution and color depth on the participant screen (i.e. the eye tracker screen for the Tobii T Series Eye Tracker, or the screen used to present the stimulus with an X Series Eye Tracker) and the operator screen (a secondary screen connected to the Tobii Studio computer).

To change the computer screen resolution settings:

Windows XP

1. Open the Start menu and click Control Panel.
2. In the Control Panel, click Appearance, Themes, and then click Display.
3. On the Settings tab, under Screen resolution, drag the slider and then click Apply.
4. When prompted to apply the settings, click OK. Your screen will turn black for a moment.
5. Once your screen resolution changes, you have 15 seconds to confirm the change. Click Yes to confirm the change; click No or do nothing to revert to your previous setting.
6. To improve the graphics card performance and reduce the hard disk load, select High (16 bit) for Color Quality. For studies that require higher color quality, use a computer with high performance and contact Tobii Support for recommendations.

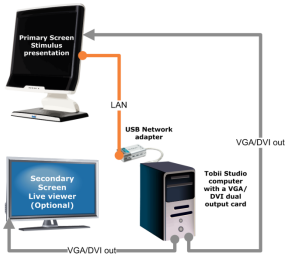
Windows 7

1. Open the Start menu on your computer and select Control Panel
2. In the Control Panel, find the Appearance and Personalization category and click Adjust screen resolution.
3. Click the Display: drop-down list and select the display you want to set up.
4. Click Resolution: and make sure it is set to 1024x768 or 1280x1024 for the Tobii T60 and T120 Eye Trackers, and 1920 x 1200 (1080p) for the Tobii T60XL Eye Tracker.

5. Once your screen resolution changes, you have 15 seconds to confirm the change. Click Yes to confirm the change; click No or do nothing to revert to your previous setting.
6. To improve the graphics card performance and reduce the hard disk load, select High Color (16 bit) for Color Quality. Click Advanced settings and then click the Monitor tab. Under Colors: select High Color (16 bit) and then click OK. For studies that require higher color quality, use a computer with very good performance and contact Tobii Support for recommendations
7. Click OK to accept the changes and close the Control Panel.

12.1.2 Configuring a dual-screen computer setup

This step is only required if you plan to use your system with an extra monitor to show Tobii Studio Remote Viewer and if both the eye tracker monitor and the Remote Viewer monitor are both connected to the Tobii Studio computer.



In order to use two screens, your computer must be equipped with a dual-head graphics card and you must have two monitors connected to this card. One monitor is the eye tracker monitor, where the stimuli are shown and one is a regular monitor for Tobii Studio Remote Viewer.

To change the computer display settings:

Windows XP

1. Once the dual display graphics card is installed with the card-specific drivers and the two screens are connected to the computer, right-click your computer desktop then select Properties.
2. In the Display Properties dialog box, click the Settings tab.
3. On the Settings tab you should see two icons representing the two monitors. Click the Display drop-down list and select your external monitor.
4. Select the Extend my Windows desktop onto this monitor check box.
5. Click the monitor icons and drag to configure their relative position.
6. The eye tracker screen should be set as the primary screen (monitor) and the Remote Viewer screen as the secondary. Click Identify to see which screen is the primary screen.
7. To set the eye tracker screen as the primary monitor, select the eye tracker monitor in the Display list and then clear the Use this device as the primary monitor check box.

This check box is unavailable when you select the monitor icon that is currently set as the primary monitor. For some graphics cards, you need to click Advanced on the Settings tab to access this function.

8. Make sure that the screens have the same resolution. Read the previous section for more information on how to set the screen resolution.
9. Click OK or Apply to view the changes.

If the Display drop-down list does not show the two monitor icons, then Windows is not detecting the secondary monitor. Check if the cables to the monitor are plugged into the right connectors, that the connection source is set correctly on your monitor and whether your computer's graphics card supports dual view. Please read the manual for your monitor for more information.

This check box is unavailable when you select the monitor icon that is currently set as the primary monitor. For some graphics cards you need to click Advanced on the Settings tab to access this function.

10. Make sure the screens have the same resolution. See the previous section for more information on how to set the screen resolution.
11. Click OK or Apply to view the changes.

If the Display drop-down list does not show the two monitor icons, then Windows is not detecting the secondary monitor. Check if the cables to the monitor are plugged into the right connectors, that the connection source is set correctly on your monitor and whether your computer's graphics card supports dual view. Please read the manual for your monitor for more information.

Windows 7

1. Once the graphics card is installed with the card-specific drivers and the two screens are connected to the computer, open the Windows Start menu and select Control Panel.
2. In the Control Panel, find the Appearance and Personalization category and click Adjust screen resolution.
3. The Change the appearance of your display dialog box displays the information on how many monitors you have connected to the computer and which screen is set as the primary (Display 1) and which is set as the secondary (Display 2).
4. Click the Multiple displays drop-down list, select Extend these displays, and then click OK.

If the option Multiple displays is not shown in the dialog box, Windows is not detecting the secondary monitor. Try clicking Detect to automatically detect the monitor. If Windows still cannot find the monitor, then check if the cables to the monitor are plugged into the right connectors and that the connection source is set correctly. Read your monitor manual for more information.

5. To set the eye tracker screen as the primary monitor, select the eye tracker monitor in the Display list and then select the Make this my main display check box.
6. Make sure that the screens have the same resolution. Read the previous section for more information on how to set the screen resolution.

12.1.3 Enabling the 3GB switch in Windows (32–Bit)

This is only necessary if you are using a Windows Vista, 7 or 8 32–Bit Operating System. If you are using a 64–Bit version of these Operating Systems this will be automatically activated for you. To enable your 32–Bit version of Windows Vista, 7 or 8 to utilize 3GB of RAM please follow the below steps:

1. Open an elevated command prompt by clicking the start menu and searching for "Command Prompt", once this has been located, right-click and select "Run as administrator".
2. In the command prompt please type — *"bcdedit /set IncreaseUserVA 3072"* and press enter (It should look like this:).

```
C:\windows\system32>bcdedit /set IncreaseUserVA 3072
```

3. After this is completed, please restart your computer.

If you wish to change this setting back to the default settings; simply run through steps 1-3 again however instead of using the command listed in "Step 2" type the following and press enter — *"bcdedit /deletevalue IncreaseUserVa "*, then restart your computer.

12.2 Tobii Studio Global Settings dialog box

The Global Settings dialog box contains important settings that affect data recording and analysis across all Tobii Studio projects. Consequently, if you change the settings for one project, these changes will affect the subsequent recordings and analyses in Tobii Studio even if you switch to a different project. If you wish to repeat tests or analysis, or simply replicate tests from a previous Tobii Studio project, make sure you note the different settings used in the test.

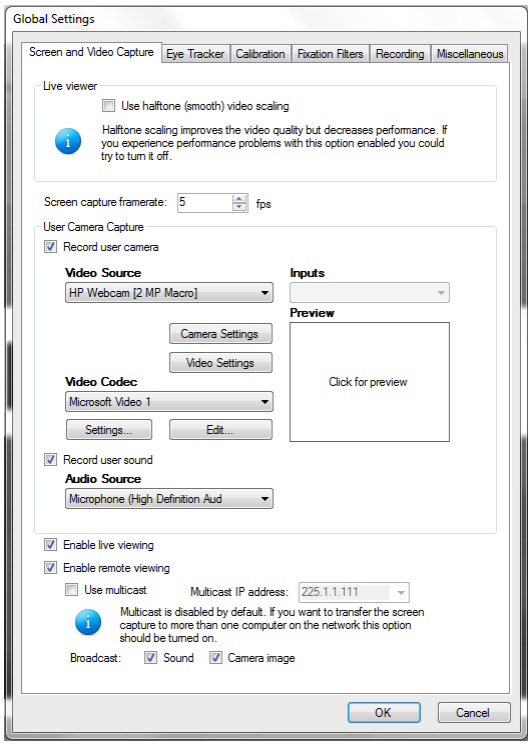
The Global Settings dialog box can be opened in two different ways: from the Design and Record tab, click the Setup drop-down menu and select Settings; or click Tools on the Tobii Studio menu bar and select Settings.

12.2.1 Screen and video capture settings

The first tab in the Global Settings dialog box, the Screen and Video Capture tab, has various settings for configuring the video recordings from the screen capture and user camera, the user sound, and allows you to enable local and remote Remote Viewers.

The halftone video scaling option determines how the video is scaled if the Remote Viewer window size is changed. Halftoning is a technique used to make 24-bit color gradients look better on 256-color displays. Halftoning normally increases the size of graphics files. If the Use halftone (smooth) video scaling check box is selected, the video will be streamed with a better image and details will be easier to see. However, this option requires more processor resources and can lower the computer's performance.

Type a value in the Screen capture frame rate: field to change the frame rate of the screen recording of the participant's activities on the screen. In a video recording, a frame is one of the many still images that compose the complete moving picture and is usually expressed in number of frames per second. The higher the frame rate the more processor resources will be consumed and the larger the size of the video file. The default value for Tobii Studio is 5 frames per second (FPS).



To set the user camera video capture properties:

1. Choose the video source by selecting a camera from the Video Source drop-down list.
2. If the device has more than one input (e.g. S-video and composite), specify the input you want to use for the video recording by selecting it in the Inputs drop-down list.
3. Choose the codec you want to use to convert and/or compress the video signal during the recording by selecting a codec from the Video Codec drop-down list. The choice of codec will impact the video quality, file size, and CPU load during recording. For most purposes, the Microsoft Video 1 codec is recommended.
4. Click the Settings... button to set the temporal quality ratio of the video compression. The higher the quality ratio, the better the video quality will be, but the more CPU resources will be consumed.
5. Click Edit... to enable (or disable) codecs from the list. Select the codec from the disabled list and click the left direction arrow to add the codec to the Video Codec drop-down list. Do the opposite to remove a codec.
6. Click the Preview box to preview the video streamed from the device.
7. Select the Record user sound check box to enable user sound recording and choose the microphone used to record the user form the Audio Source drop-down list.

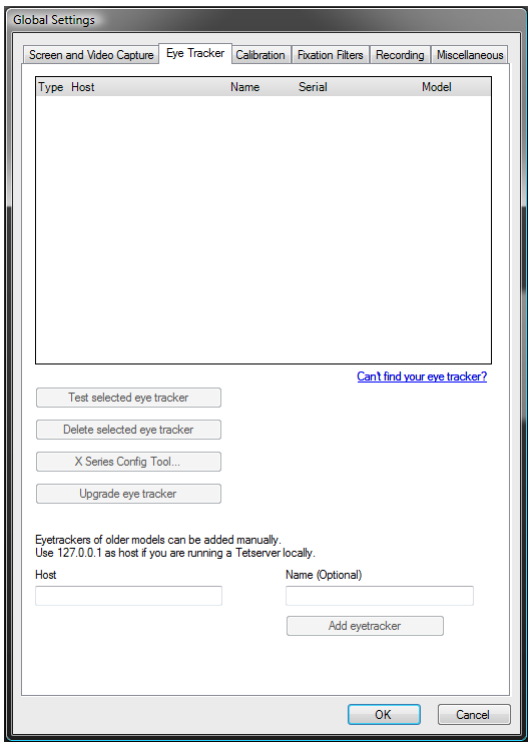
To enable live viewing:

1. Select the Enable live viewing check box to enable the local Remote Viewer. If this option is unchecked you will not be able to open the local Remote Viewer window.
2. Select the Enable remote viewing check box to use Studio Logger Remote Viewer. If this option is unchecked, you will not be able to view the Remote Viewer window in the Remote Desktop pane of Studio Logger.
   When remote viewing is enabled, you can choose to allow Tobii Studio to connect to several Studio Logger clients (several computers running the Studio logger). Select the Use multicast check box to create a multicast IP address and enable multicasting. The IP address is displayed in the Multicast IP address field.

   Select the Sound and Camera image check boxes to enable broadcasting of the user camera image and sound to Studio Logger.

12.2.2 Eye Tracker browser and hardware settings

The Eye Tracker tab allows you to select and connect to the eye tracker connected to the Tobii Studio computer (as well as configure the connection to old eye tracker models), update the eye tracker firmware and configure the X Series Eye Tracker setup.



The first element in the Eye Tracker tab is a list of eye trackers that are connected either to the Tobii Studio computer or to the network the computer is connected to. The list displays information on whether the connection to the eye tracker was made automatically or manually (Type), the address used to connect with the eye tracker (Host), the name (Name) and serial number (Serial) of the eye tracker, and the type of eye tracker (Model).

To select an eye tracker, click the row in the list that corresponds to the eye tracker and then click the Test selected eye tracker button. A message showing the status of the connection is displayed.

If you are unable to see your eye tracker in the list, click Can't find your eye tracker? to restart the protocol used to communicate with the eye trackers (Bonjour). If you are still unable to connect to the eye tracker, see the troubleshooting section of the eye tracker user manual or contact Tobii Support.

The Delete selected eye tracker button is used to remove eye trackers that have been manually added to the list.

If you are using a Tobii X Series Eye Tracker, click the X-Series Config Tool... button to open the X Series Configuration Tool dialog box and set up the X Series Eye Tracker (the button is only available if you select a Tobii X Series Eye Tracker).

Earlier eye tracker models (e.g. 1750 and X50) are not detected automatically by Tobii Studio. If you are using a Tobii -50 Series Eye Tracker, you need to set up the connection manually. Type the IP address of the computer running the TET Server in the Host field, or type 127.0.01 as the address if the TET Server is running on the same computer as Tobii Studio. Type a name for the eye tracker in the Name field (optional) that can be used to identify the eye tracker in eye trackers list. Click Add eye tracker to connect to the eye tracker and display it in the list.

12.2.3 Calibration Settings

Read *4.3.1 Calibration settings* to learn how to change the calibration settings in Tobii Studio.

12.2.4 Fixation filter settings

The Fixation Filters tab allows you to configure the gaze data and fixation filter calculations. These settings affect how the fixation data is visualized and the eye tracking metrics calculated in Tobii Studio, but do not affect the raw gaze data. To recalculate the fixation data, simply change the settings on the Fixation tab.

The gaze data received from the eye tracker consists of gaze point coordinates, distance to the eye tracker, pupil size, etc., for the left and right eyes. The accuracy of the human eye is not identical in both eyes. One of the eyes is usually more dominant and more accurate than the other. In some cases, the difference between the two eyes is so great that it will affect the accuracy of the analysis. If so, it is best to use the data from the dominant eye and discard the data from the other.

On the Fixation Filters tab, you can choose to discard the data from one of the eyes or average the data from both eyes by clicking the Eye Selection drop-down list (Eye Selection Filter) and selecting Left, Right, or Average.

After selecting the gaze data (Left or Right eye) or recalculating the gaze points (Average), you can choose either to not process the data further by selecting the Raw Data Filter check box or to process the gaze data further into fixations using the Tobii Fixation Filter or the ClearView Fixation Filter.

For more information on what fixation filters are and how they work, please read *6 Defining fixations*.

12.2.5 Recording settings

Under the Recordings tab you can configure the recording settings.

12.2.5.1 Recording Shortcut Keys

The ESC key on your keyboard is the default key for ending and exiting the recording, while F10 is the default key for moving the presentation to the next media element.

To change the recording shortcut keys:

1. Click the End the recording drop-down list and select a keyboard key from the list.
2. Click the Move to next test element drop-down list and select a keyboard key from the list.
3. Click the Restore default button to restore the shortcut keys to ESC and F10.

12.2.5.2 Timing Settings

Tobii Studio initiates the stimulus presentation by sending a command to the computer's graphics card to write the stimulus data to its memory. When this process is finished the stimulus is sent to the monitor via a VGA or DVI connector. In the monitor the stimulus is first stored and buffered by the screen controller card (typically 1 + frames) and then sent to the display following the vertical screen refresh rate. Refresh rates are measured in Hz and represent the number of times per second the monitor refreshes the pixels on its display. We can calculate the time interval between two screen refresh cycles by dividing 1000 ms (=1 second) by the refresh rate, for example, a 60 Hz refresh rate is equivalent to an image update every 16.6 ms. If an image is sent to the screen while it is refreshing, the offset for its display will depend only on how fast each pixel on the screen changes, i.e. the response time of the display. However if the image is sent to the display between two refresh cycles, then the offset will vary depending on where in the cycle the image becomes available. For example, if the image is available in the middle of a 60 HZ refresh cycle, it will take 8.34 ms extra to be shown on the screen, as it has to wait for the next refresh event to be displayed. The response time of the display is the amount of time that it takes for a pixel to change color and/or brightness, when the image arrives at the display. Typically this interval varies with the degree and order of the change. For example, the time it takes for a pixel to change from white to black is different compared to when it changes from black to white.

For further information related to the timing performances, please refer to section 7 – *Tobii Studio Critical Timing Performance* of the Tobii Studio 3.1 Release Notes document that can be found on the Tobii website at www.tobii.com under the Support & Downloads section.

To choose the image presentation mode:

1. Choose one of the options in the *Image timing adjustment* section, according to the description below (please note that the timing accuracy settings have tooltips for more information):
    - *Optimal* – this is the default setting and it is using the same image presentation process as in Tobii Studio 3.1.0. This option gives you the following results in terms of presentation timing accuracy:
    - typical timing results < 10ms, when using a system that meets the requirements displayed in the tooltip
    - typical timing results <50ms, when using a system that meets the requirements in the Tobii System Recommendations document (that can be found on the Tobii website at http://www.tobii.com under the Support & Downloads section):

You should change this and try to use one of the other options if you experience problems such as the image freezing during the recording or preview, etc.

- *Good* – to be used if the hardware system used does not meet the system requirements (please refer to the System Recommendations document that can be found on the Tobii website at http://www.tobii.com under the Support & Downloads section) and if you have trouble using the *Optimal* setting (such as the image freezing during the recording or preview, etc.). Typical timing results on recommended systems <50ms or better:
- *Compatible* - is the image timing settings used in Tobii Studio 3.0.x versions and lower. This is to be used only if you experience problems in using both *Optimal* and *Good* options, or when you are replicating a study that was performed using an earlier version of Tobii Studio (3.0.x or lower) and you wish to compare the results. Please note that the following features are not supported with this option:
- Light sensor box/Stim Tracker
- Display lag adjustment

The display lag adjustment feature enables you to correct the ImageStart event timestamps (event that represents the instant Tobii Studio recorded as the start of an image presentation) and minimize the offset introduced by the monitor performance. More specifically it is used to account for the vertical synch frequency cycles of the screen controller card of your monitor. Most monitors will take the period of at least 1 vertical synch cycle (e.g a 60Hz monitor will take at least 16.6 ms) until the whole image on the screen is updated, however the extent to which an image is buffered before being presented, and the response time of the pixels can vary greatly between monitors.

The *Frames* and *Milliseconds* setting boxes can be used to change the value of the offset compensation for the StartImage event timestamp. Display lag frames changes the value by screen refresh cycle, whereas the Display lag in milliseconds can be used to fine tune the offset compensation values. When you change one of the settings the other will adjust accordingly. To change the values click the adjustment arrows or type a value in the setting box.

When this feature is activated it will affect the ImageStart event timestamps of your recordings. Make sure you disable it if you are running tests where you do not want or need to adjust for the display lag. If you are using a CRT monitor to display your stimulus you should deactivate this feature.

12.2.5.3 Light Sensor Trigger Settings

The light sensor trigger feature enables you to automatically add black or white squares to stimuli images during the image presentation. These black and white squares will be used to trigger the light sensor of the Cedrus StimTracker for TX300 Eye Tracker or other supported systems. This functionality is currently only applicable for image stimuli. If other types of stimuli are available on the recording timeline, a warning message will be displayed when a recording is initiated. Recordings with mixed sets of media can be performed, but only the images will be provided with the colored square defined by this feature and the other stimuli might result in false trigger events being detected by the light sensor.

The light sensor trigger can be customized in terms of size and position.

To set the position and size of the square:

- Top Left
- Top Right
- Bottom Left
- Bottom Right

12.2.5.3.1 Verifying the position and size of the square

As an aid to positioning and calibrating the light sensor within the area covered by the colored square, it is possible to get a preview of the size and position of the square (e.g. see the image below). This can be done by pressing either the "Show white square" or "Show black square" button. The difference between the images shown when clicking the buttons is that if the "Show white square" button is clicked, a black background with white text and a white square is shown. If the other button is clicked, a white background with black text and a black square is shown.

When performing a recording with the light sensor trigger feature enabled all images will automatically be coded with black or white squares in the selected corner, i.e. the first image in the recording will have a white square, the second image will have a black square, the third image will have a white square and so on.

When performing a recording with a light sensor attached to the monitor please note that the light sensor might be triggered by various other events prior to the start of the recording, such as the Tobii Studio calibration procedure or the Windows desktop which is briefly shown at the start and the end of a Tobii Studio recording (see the image on the previous page). Tobii Studio will only register events that occur after the start of the recording.

In order to reduce the amount of non stimuli related event markers in the data, we recommend the following settings and procedures:

- Set the background of your desktop to black.
- Clear the area covered by the light sensor of desktop icons.
- Close any other open application than Tobii Studio before starting the recording.
- Use a dual screen setup, with the eye tracker screen setup as your secondary screen. You can then run studio on your primary screen and only present the calibration and the stimuli on the secondary screen.
- In a single screen setup run Tobii Studio non Maximized window mode and avoid dragging the Tobii Studio window to the area where the light sensor is placed.
- Hide the Windows Task Bar if the sensor is placed on the bottom of the screen.

If these instructions are followed the two first events should be related to the calibration procedure, thereafter all other events should be related to the stimuli.

Note: It is recommended to always test and evaluate the performance of your system and your setup before performing a real recording with a light sensor and the light sensor trigger feature enabled.

12.2.6 Miscellaneous settings

Some dialog boxes in Tobii Studio provide the option "Don't show this again." When selected, the specific dialog box will not appear in future similar operations. Clicking the Show all warning and instruction dialog boxes button removes the check marks from all dialog boxes in which the "Don't show this again" option was selected.

By default, the Remote Viewer and track status window will be displayed at the last location (secondary or primary screen) where they were active. If their previous location was on a secondary screen which is no longer connected, they will not be shown on the primary screen. By clicking Forget Remote Viewer window position, they will be shown on the primary screen again.

13 Tobii Studio media limitations

Below is a list of the maximum number of media files, the amount of recordings, and the duration of media presentation that can be used in a test.

1280 x 1024 pixels screen/image resolution:

- 500 images, each image presented for 1 second — up to 150 recordings
- 4 images, each image presented for 5 seconds — maximum 1200 recordings
- 32 movies that are 20 seconds long – up to 150 recordings (1280 x 720 pixels movie resolution)
- 10 movies, 60 seconds long >up to 150 recordings (1280 x 720 pixels movie resolution)

1920 x 1200 pixels screen/image resolution:

- 20 movies, 20 seconds long — up to 150 recordings (1920 x 1200 pixels movie resolution)

The limitations are only valid for tests run on a computer fulfilling the recommendations in the Tobii Studio System Requirements and Recommendations (download the system recommendations document from www.tobii.com).

14 Appendixes

14.1 Appendix A — Tobii Studio critical timing information

Tobii Studio computing operations are subject to the operating system allocation of memory and processor resources. As a consequence, time offsets may occur when recording an eye tracking session. These offsets may vary according to the eye tracker display hardware, the type of computer used in the test (laptop vs. desktop, processor speed, RAM, graphics card), the video capture devices (capture cards and cameras), third-party software installed and running on the computer, and the type of stimuli and stimuli format used in the test (image, video, codecs).

Tobii Eye Trackers hardware display timing information (TFT screen & controller)			
Eye Tracker	**Native resolution** (pixels)	**Controller refresh rate** (Hz)	***TFT Response time** (ms)
1750	1280×1024	60-75	5-25
T120 & T60	1280×1024	60-75	5-16
T60XL	1920×1200	60	16

*These values represent typical values for a full transition of a pixel from black-white-black.

Test results for the offset of the start time of the stimulus display – display connector, graphics card, and type of computer (Dell Precision T5400 desktop, M6300 and M6400 laptop)						
Stimulus	Display connector	Card*	Computer	Eye tracker	Windows OS	Offset (ms), mean±s.d.
Single image	DVI	Nvidia	T5400	T120	XP	19±5
	DVI	ATI	T5400	T120	XP	15±5
	VGA	Nvidia	M6300	T60	XP	43±7
	DVI	Nvidia	M6300	T60	XP	39±4
	DVI	Nvidia	M6400	T60		43±6
Single video	DVI	Nvidia	T5400	T120	XP	25±5
	DVI	ATI	T5400	T120	XP	30±5
	VGA	Nvidia	M6300	T60	XP	33±7
	DVI	Nvidia	M6300	T60	XP	35±9

*Graphics card: Nvidia – NVidia Quadro FX570 256MB (T5400), NVIDIA Quadro FX 1600M 256MB (M6300), NVIDIA Quadro FX 2700M Graphics with 512MB (M6400). ATI – ATI FireGL V3300 128MB** Windows Vista appearance settings optimized for better performance

In addition to the stimuli display offsets, you can also encounter video and sound capture offsets that are caused by the latency between image recording or capture (e.g. at image sensor exposure when using a camera) and the Tobii Studio timestamps.

Shows the different configurations of computer hardware, operative system and stimulus that have been used to test the stimulus display start timing and duration offset.			
Computer	Dell T5500 Workstation*		Dell M6600 Mobile Workstation**
OS	Windows 7	Windows XP	Windows 7
Tobii Eye Trackers	T60XL & T120	T60XL & T120	T60XL
Image offset	3.1.0.6542-beta	3.1.0.6545-beta	3.1.0.6542-beta
Video offset	3.1.0.6542-beta	3.1.0.6545-beta	3.1.0.6542-beta
Image duration	3.1.0.6542-beta	-	-

*Intel Xeon E5540 2.53GHz; 4GB 1066MHz DDR3; NVidia Quadro FX580 512MB

** Intel Core i7-2720QM 2.2 GHz; 4GB (2X2GB) 1333MHz DDR3; NVidia Quadro 3000M 2GB

14.1.1 Stimulus start time offset (images and videos)

This offset measures the interval of time between the moment Tobii Studio timestamps the start of the stimulus presentation (ImageStart and VideoStart event) to the actual instant the stimulus is displayed on a screen. Recent tests show that when using Tobii Studio with Tobii recommended hardware configurations and devices these offsets can be maintained at a low value, below 50 ms.

Summarizes the test results of the stimulus display start time offset tests. All setups show that the offset between Tobii Studio timestamps and the start of image or video display, is below 50 ms. Values reported are mean ± s.d. in milliseconds.					
Computer	Dell T5500 Workstation				Dell M6600 Mobile Workstation
OS	Windows 7		Windows XP		Windows 7
Tobii Eye Trackers	T60XL	T120	T60XL	T120	T60XL
Image offset	16.5±2.5	11.5±4.4	22.1±1.4	19.4±1.7	21.6±1.7
Video offset	30.9±5.0	17.4±5.1	29.4±5.2	16.9±3.8	29.1±5.1

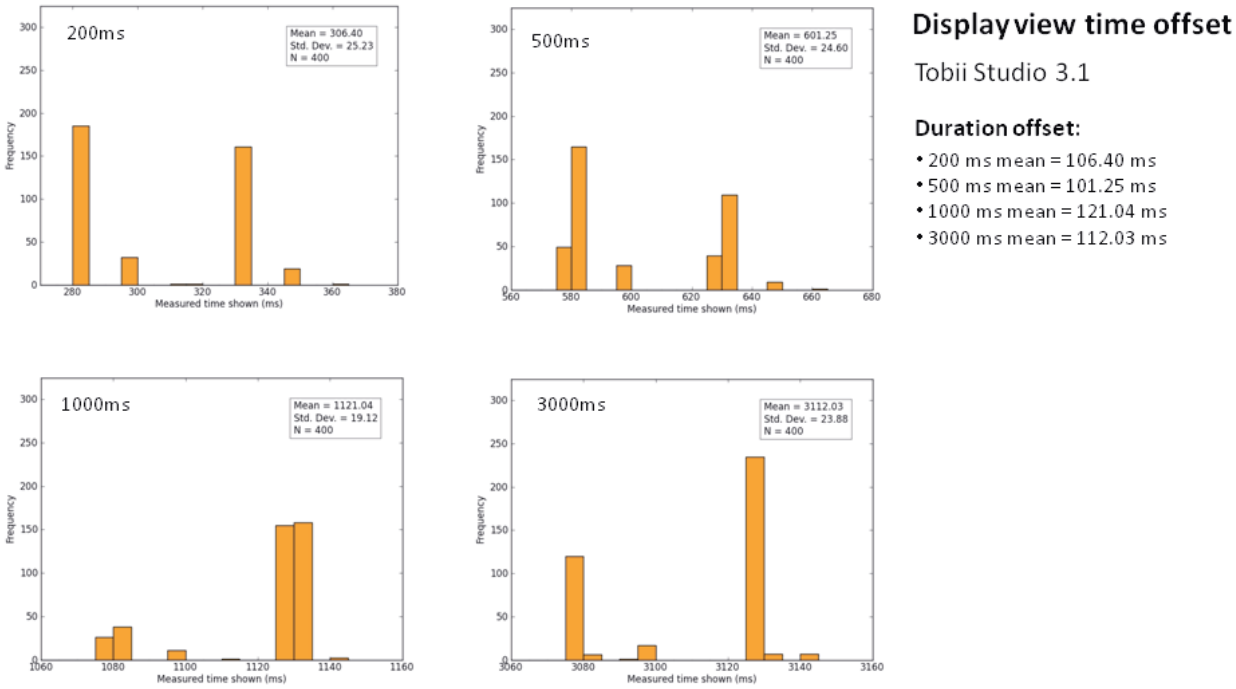
The video codecs used in this test were MicrosoftVideo1 and XviD. Images and videos were displayed at native screen resolutions, with the exeption of the videos displayed on the Tobii T60 XL Eye Tracker. The resolution used for these videos was 1920 x 1080 pixels.

The display lag adjustment feature was not active during the Start Time Offset measurements for images.

14.1.2 Display view time offset (images)

This offset measures the difference between the view time value set in the Image Properties box (Image Element setup) and the actual duration of the image presentation on the screen. Current tests show that when the view time is set to a value equal or above 1000 ms, it will be displayed for an average of 104-112% of the set time view value (e.g. at 1000 ms the stimulus is displayed on the screen between 1075-1140 ms), whereas for view times below 1000 ms (e.g. 500 or 200 ms) the average recorded duration can vary between 120 and 153% of the view time setting value.

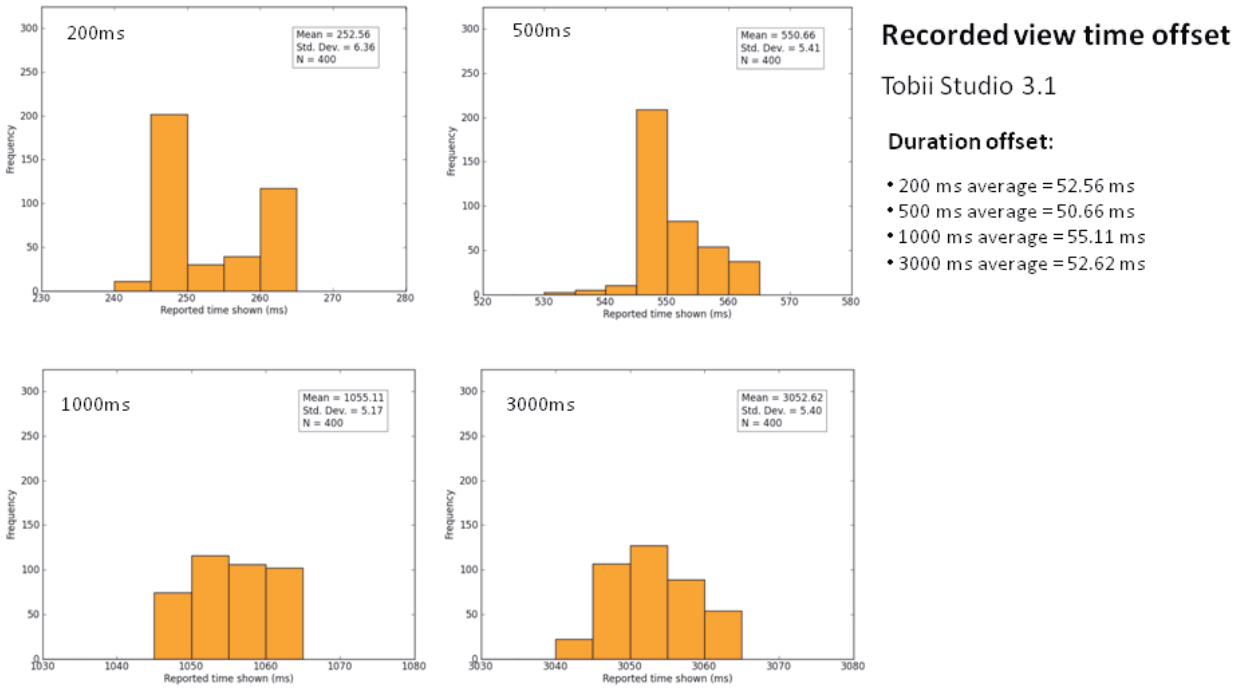
The figure below displays the distribution of the duration of the actual image presentation on the screen according to four View Time values: 200, 500, 1000 and 3000 ms. Recording performance is relatively more accurate when the View Time is set to values above 1000 ms.



14.1.3 Recorded view time offset (images)

This offset represents the difference between the recorded image view time and the view time set in the image Properties box (Image Element setup). Current tests show that when the View Time is set to a value equal or above 1000 ms, the recorded duration will vary on average between 106-102% of the set duration value (e.g. at 1000 ms the stimulus is recorded between 1045 and 1060 ms), whereas for view times below 1000 ms (i.e. 500 or 200 ms) the recorded duration will vary on average between 110 and 126% of the view time setting value.

The figure below displays the distribution of the recorded stimulus presentation durations according to four View Time values: 200, 500, 1000 and 3000 ms. Recording performance is more accurate when the View Time is set to values above 1000 ms.



14.1.4 Recommendations

When designing an experiment, it is always good practice to test both experimental procedure as well as the equipment you will be using to perform the tests. If you are conducting eye tracking experiments that require high timing precision, we strongly recommend testing your eye tracking setup with the stimuli you will be presenting, as well as conducting a pilot test to assess the quality of the data.

Tobii Studio timing offsets can be reduced by following these recommendations:

- Optimize your computer hardware by using Tobii recommend components. For an overview of the configurations tested by Tobii Technology, see the next table. For a more detailed list of Tobii Eye Tracking Recommended components, please read the system recommendations for Tobii Studio and TX-series Eye Trackers.
- The computer running Tobii Studio should have the least number of processes running in the background. This means that you should disable or uninstall any unnecessary programs that might be running in the background (anti-virus software, firewall software, anti-spyware software, Skype or other chat/communication programs). Ideally, use the computer only to run Tobii Studio tests and analysis.
- It may help to disable or disconnect Bluetooth, WLAN/Wifi, and network connectors and to remove CDs or DVDs from disk drives.
- Use a direct connection between your computer and Tobii Eye Trackers. For more information on how to connect the computer and Tobii Eye Trackers, please read the section entitled “Connecting Tobii Eye Tracker” in your eye tracker user manual.
- Use images and movies as stimuli using the recommended formats and codecs (see table below).
- Disable Live Viewer, User Sound, and User Image (from the user camera).
- Don't run your study at excessive screen resolutions. Choose something reasonable for your purpose. Higher resolutions take up precious video RAM and increase the time for clearing the frame buffer, drawing your stimulus, and for post-processing operations.
- Optimize Windows 7 or XP for better performance. For more information visit: http://www.microsoft.com/windowsxp/using/setup/maintain/improveperf.mspx.
- Make sure that the energy saving options of your computer do not slow down the processor and other subsystems to save power or battery life. This is especially important for laptops running on battery power.
- Running two displays simultaneously requires more video RAM and processor resources from your graphics card, plus some additional management overhead in the graphics driver. This can cause lower graphics performance and therefore lead to missed stimulus onsets when running complex stimuli on high resolution, high refresh rate displays, especially when using older mobile graphics chips with a low amount of local video RAM.

- **Test the timing of your setup by following the test procedures described in Tobii Studio Timing Testing Guidelines.** Contact Tobii Support or your sales representative if you wish to receive a copy of the document**.**

Recommended stimulus				
Stimulus	**Format**	**Codec**	**Size**	**Frame rate**
Image	JPEG, BMP	-	1280x1024; 1920x1200 (T60 XL)	-
Video	AVI	Techsmith1, dviX, MV1, XviD	1280x1024; 1920x1200 (T60 XL)	maximum 25 fps

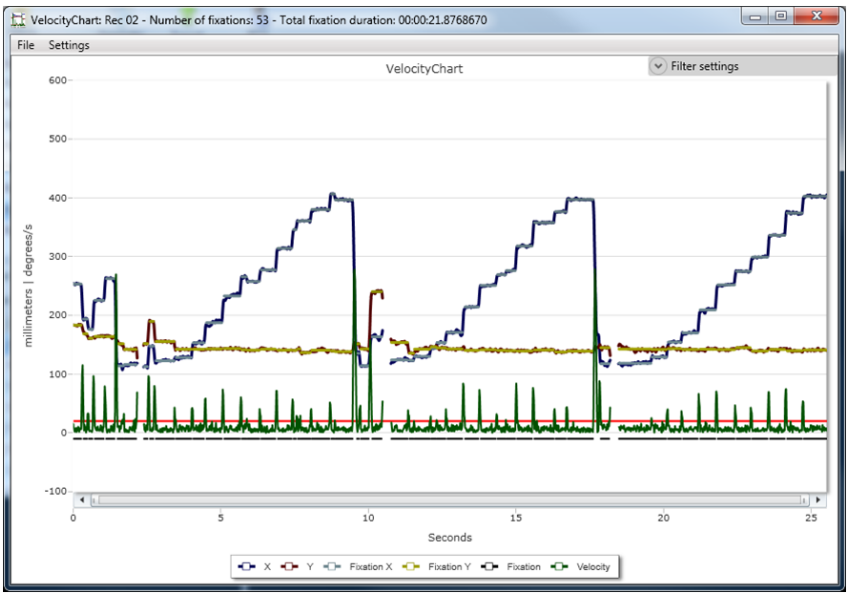
For information about the minimum system requirements and recommendations for optimal performance, please read the Tobii System Requirements and Recommendations , available at www.tobii.com under the Support and Downloads section.

Detailed documentation on Tobii Studio timing of stimulus display as well as Tobii Eye Trackers sample timing information is available upon request. Contact Tobii Support or your sales representative in your area to obtain a copy of *Timing Guide for Tobii Eye Trackers and the eye tracking software* whitepaper.

14.2 VelocityChart - Visualizing eye tracking data on a timeline

VelocityChart in Tobii Studio plots the angular eye velocity, gaze coordinates (raw or processed), and the classified fixation coordinates of a recording. The main purpose of VelocityChart is to help the user set the parameters in the data processing functions, particularly when using the I-VT fixation filter.

Below, a VelocityChart showing eye tracking data on a timeline:



The straight red line in VelocityChart above shows the Velocity threshold in the I-VT fixation classifier. The other lines described on the chart legend are:

- X/Y: gaze coordinates (raw or processed) (mm)
- Fixation X/Fixation Y: Fixation coordinates (mm)
- Fixation: Indicates fixations found
- Velocity: Absolute value of the eyes angular velocity (degree/second).

14.2.1 Important Notifications

- VelocityChart is a separate application. Adjustments to the fixation filter parameters within VelocityChart need to be transferred to Tobii Studio to have an impact on replay, visualizations, statistics and text export. The transfer procedure is described in *14.2.2 Using VelocityChart to tune the Raw Data or the I-VT Fixation filters*
- VelocityChart can only be applied on recordings made with Tobii Studio 2.3 or later. The menu option Launch VelocityChart will appear grey for recordings made with previous versions of Tobii Studio
- VelocityChart only supports the Raw data filter and the I-VT fixation filter
- VelocityChart plots one recording at the time and only the first 4000 samples of the recording. Adjusting the data processing parameters to fit all recordings while still preserving fine grained fixations is a complex task that requires training and experience. The default values have been set to work in most cases.

14.2.2 Using VelocityChart to tune the Raw Data or the I-VT Fixation filters

VelocityChart is a separate software application, but is launched from within Tobii Studio.

To launch the VelocityChart application:

1. Select the Replay tab in Tobii Studio.
2. In the Recordings pane, right-click on the recording you want to open in VelocityChart. Click Launch VelocityChart. The VelocityChart opens in a new window.

Consider using a recording where the level of noise is relatively high when selecting which fixation filter settings to use for a study. An indication of noise level may be the percentage of samples that was collected, or if you noticed that the calibration of a specific participant showed long error vectors (green lines) in the calibration results (read *4.3.2 Making recordings*)

To apply the Raw Data/I-VT Fixation filter in VelocityChart:

1. In the Menu bar click Settings.
2. Select Filter Settings... The dialog box has the same layout as the Fixation filter dialog in Tobii Studio. The startup parameter values in VelocityChart fixation filter dialog have been retrieved from the same parameters set in Tobii Studio.
3. In the Fixation filter dialog box, select Raw Data/I-VT Fixation filter in the Fixation filter drop-down menu.

To zoom-in to a representative part of the recording:

1. In VelocityChart, create a zoom window with the mouse by pressing the left mouse button while dragging the mouse along the timeline and then releasing the mouse button.
2. Adjust the zoom window by dragging the scroll box in the horizontal scroll bar.

To adjust the parameters in VelocityChart fixation dialog box:

1. In VelocityChart Fixation filter dialog box, adjust the parameters to obtain suitable data processing. Finding the best parameters values to fit all recordings while still preserving fine grained eye tracking data is a complicated task that requires training and experience. The default values have been set to work in most cases. These release notes will not cover the methods of evaluating different parameter settings.
2. Click Apply to apply the changes in VelocityChart. Fixation filter parameters in VelocityChart do not affect fixation filter parameters in Tobii Studio.

To apply VelocityChart's Raw Data/I-VT Fixation filter parameters values in Tobii studio:

1. In VelocityChart's Fixation Filter settings dialog, click Save filter config. The Save fixation filter configuration to file dialog opens.
2. Select location and enter a file name for the filter configuration file.
3. Click save.
4. Open the Fixation filter dialog in Tobii Studio. The Fixation filter dialog is found in the Settings dialog, in the Tools menu.
5. Click Load filter config.

Make sure you are in the Fixation filter dialog in Tobii studio and not the one in VelocityChart.

6. Locate the configuration file in the Load fixation filter configuration from file dialog.
7. Double-click the filter configuration file to open it in Tobii Studio.
8. Click Apply.

(The settings can also be transferred simply by entering the parameter values from the fixation filter dialog in VelocityChart into the Fixation filter dialog in Tobii Studio manually.)

14.2.3 Velocity Chart Settings

Within the VelocityChart application, you can set what data to be shown in the chart, from the Settings menu.

To change the Velocity Chart settings:

1. Click the Show X/Y drop-down menu and select what gaze coordinate data should be shown (fixation coordinates included).
2. Click the Gaze data drop-down menu and select how data should be processed before it is shown.

Preprocessed, meaning according to fixation filter settings. Data processing functions implied: Gap fill-in and Noise reduction. Eye Selection cannot be disabled.

3. Select the Show Fixations check box to show fixations in the chart.
4. Select the Show Velocity check box to show the angular velocity. (Only applicable using the I-VT fixation filter).
5. Type in the number of data points to include in the chart in the Max samples field.

Maximum number is 4000. Charting always starts at the first sample. To plot recordings longer than 4000 samples, or segments of recordings further into the recording than 4000 samples, export gaze, velocity and fixation data from VelocityChart (see *14.2.4 Exporting gaze, velocity and fixation data from VelocityChart*) and plot data in Excel, SPSS, Matlab etc.

6. Set the scale on the Y axis by typing in the maximum Y value in the Set Max Y field.

14.2.4 Exporting gaze, velocity and fixation data from VelocityChart

The VelocityChart application enables velocity data to be exported. All data processing function parameters are presented in the header of the text export. The output format of the text export is a tab separated text file. This format can be opened using Excel, SPSS, Matlab or any other text editor of your choice.

To export gaze, velocity and fixation data from VelocityChart:

1. From the File menu choose "Text Export..."
2. In the Save fixation filter configuration to file dialog, select location and enter the file name for text export file.
3. Click Save.

The exported data is presented in the table below:

Column name	Description	Unit
Index	Indexes for the data points (values corresponding to the order of the data point).	
TimeStampMilliSec	Absolute timestamp in server time. This timestamp is not synchronized with the local time and should only be used to relate one gaze data point to another in time.	ms
ScreenX	X coordinate for the processed data point, mapped to the media coordinate system, where the origin for the coordinate system is the lower left corner of the tracking plane.	mm
ScreenY	Y coordinate for the processed data point, mapped to the media coordinate system, where the origin for the coordinate system is the lower left corner of the tracking plane.	mm
Velocity	Estimated velocity of data points measured in degrees/second.	degrees/ second

Column name	Description	Unit
FixationX	X coordinate for classified fixation point, mapped to the media coordinate system, where the origin for the coordinate system is the lower left corner of the tracking plane.	mm
FixationY	Y coordinate for classified fixation point, mapped to the media coordinate system, where the origin for the coordinate system is the lower left corner of the tracking plane.	mm
IsFixation	Data field showing “-1” where a data point has been classified “fixation”	

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